Bulletins, from October 5, 1908 to December 28, 1908

ASSOCIATION'S COPY

BULLETINS OF THE Aerial Experiment Association

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Bulletin No. XIII Issued Monday, Oct. 5, 1908

THE ASSOCIATION'S COPY.

BEINN BHREAGH, NEAR BADDECK, NOVA SCOTIA

Bulletins of the Aerial Experiment Association .

BULLETIN NO.XIII ISSUED MONDAY OCT. 5, 1908 .

Beinn Bhreagh, Near Baddeck, Nova Scotia .

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The work of the Aerial Experiment Association was suddenly interrupted on the 17th of September, 1908, by the lamentable death of Lieut. Selfridge in the accident to the Wright Brothers flying machine at Washington, D. C.

On Friday, Sept. 18, the Chairma a n accompanied by Mr. F. W. Baldwin, left Baddeck for Washington where they arrived Sunday, Sept. 20, and were joined by Mr. G. H. Curtiss and Mr. J. A. D. McCurdy from Hammondsport, N.Y.

On Monday, Sept. 21, a meeting of the Aerial Experiment Association was held at 1331 Connecticut Avenue, Washington, D.C.

Mr. McCurdy was elected Secretary of the Association, and resolutions were passed relating to the death of Lieut. Selfridge, and a resolution of sympathy for Mr. Orville Wright.

On Friday, Sept. 25, Lieut. Selfridge was laid at rest in the Natio ? n al Cemetery at Arlington, Virginia; He was given an impr r e ssive military funeral. Three volleys were fired over his grave by his comrades in arms, and the ceremonies terminated with the bugle call “taps” or “put out the lights”.

The Honorary pall-bearers represented the Army and Navy the Aerial Experiment Association, and the Aero Club of America.

For the Army appeared Major Squier, Acting Chief Signal Officer, and Lieut. Winter of the aeronautical Dept. of the Army For the Navy appeared Lieut. Creecy of the U S Marine Corps reprsenting the aeronautical Dept. of the Navy.

The Aerial Experiment Association was represented by Alexander Graham Bell, Chairman, Mr. F. W. Baldwin and Mr. J.A. D. McCurdy (Mr. Curtiss was unable to attend). 2 2 The Aero Club of America was represented by a Committee consisting of Mr. Octave Chanute of Chicago, Chairman, Prof. A. F. Zahm of Washington, D.C., and Mr. George Oakley Totten, Jr. of Washington, D.C., and Mr. Hammer of New York.

On Saturday morning Sept. 26, 1908, a meeting of the Association was held at 1331 Connecticut Avenue, Washington, D.C. Advantage was taken of the presence of Mr. Edward A. Selfridge, father of Lieut. Selfridge, and the legal representative of his heirs to pass certain important resolutions which required the unanimous consent of all the interests involved in the Association.

It was decided to continue the Association under its present organization for another period of six months ending March 31, 1909; and Mr. Charles J. Bell was appointed Trustee for the Association.

Messrs. Curtiss, Baldwin and McCurdy accompanied by Mr. Gardiner H. Bell left Washington for Hammondsport, N.Y., Sunday evening Sept. 27.

Mr. A. G. Bell left Washington, Thursday morning Oct. 1, 1908, and was joined in Boston, Friday Oct. 2 by Mr. Baldwin and Mr. Gardiner Bell who accompanied him to Baddeck where they arrived Saturday October 3.

The members of the Association are now distributed as follows:- Mr. A. G. Bell and Mr. F. W. Baldwin at Beinn Bhreagh, C.B.; Mr. G. H. Curtiss and Mr. J.A.D. McCurdy at Hammondsport, N.Y., It is understood that Messrs. Curtiss and McCurdy will come to Beinn Bhreagh as soon as possible after testing out the new aerodrome No. 4 — McCurdy's “Silver-Dart”.

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3 Mr. Gardiner Bell has been appointed assistant editor of the Bulletins of the A.E.A.

The Chairman on behalf of the Association, has addressed a note to the President of the United States a copy of which is appended suggesting that an officer of the U S Army be detailed by the War Department to take the place of the late Lieut. Thomas E. Selfridge, as observer of the work of the A.E.A. in the interests of the U S Army. A.G.B.

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WASHINGTON MEETING SEP t T . 21, 1908.

The following resolutions were adopted at a meeting of the A.E.A., held at 1331 Connecticut Avenue, Washington, D.C., Sept. 21, 1908.

Resolved : That Mr. J.A.D. McCurdy be elected as Secretary of the Aerial Experiment Association, as successor of the late Thomas E. Selfridge.

SELFRIDGE .

Resolved : That we place upon record OUR high appreciation of our late Secretary, Lieutenant Thomas E. Selfridge, who met death in his efforts to advance the art of Aviation. the Association laments the loss of a dear friend and valued associate. The United States Army loses a valuable and promising officer: And the world an ardent student of Aviation who made himself familiar with the whole progress of the art in the interests of his native country.

Resolved : That a Committee be appointed by the Chairman to prepare a biography of the late Thomas E. Selfridge for incorporation in the records of the Association.

Resolved: That a copy of these resolutions be transmitted to the parents of Lieut. Selfridge.

ORVILLE WRIGHT .

Resolved :—That the members of the Aerial Experiment Association herewith extend to Mr. Orville Wright their deepest sympathy for his grief at the death of their associate, Lieut. 5 2 Selfridge. We realize that in this pioneering of the air the unforeseen must occasionally be disastrous. We hope sincerely that Mr. Wright will soon recover from the serious injuries he has sustained, and continue, in conjunction with his brother, Mr. Wilbur Wright, his splendid demonstration to the world of the great possibilities of aerial flight.

WASHINGTON MEETING SEPT. 26, 1908 .

A meeting of the A.E.A. was held at 1331 Connecticut Avenue, Washington, D.C., Sept. 26, 1908. Present: Dr. A. G. Bell, Mr. F. W. Baldwin, Mr. G. H. Curtiss, Mr. J.A.D. McCurdy, members of the Association; also present by invitation: Mr. E. A. Selfridge, MR. S. W. Selfridge, Mr. J. S. Selfridge, Mr. Octave Chanute, Mr. Gilbert H. Grosvenor, and Mr. Gardiner H. Bell.

The special object of the meeting was to consider the fu ? t ure of the Association as affected by the death of Lieut. Thomas E. Selfridge.

For the information of Mr. E. A. Selfridge, father of the late Lieut. Thomas E. Selfridge, an address was made by the Chairman giving the history of the Aerial Experiment Association, and explaining what interest the late Thomas E. Selfridge ha s d in the work of the Association. The address was taken down by a stenographer and will appear in a forthcoming Bulletin?

Opportunity was taken of the presence of Mr. E. A. Selfridge, legal representative of the heirs of the late Thomas 6 3 E. Selfridge to pass resolutions requiring unanimous action o n the part of the Association, Mr. E. A. Selfridge voting in the name and stead of his son, the late Thomas E. Selfridge, so as to obtain the unanimous consent of all the interests involved. The following resolutions were adopted:—

(1) Resolved: That the legal representative of the heirs of our deceased member, Lieut. Thomas E. Selfridge shall have the right to attend any of the meetings of the Association and vote at such meetings in the name and stead of the late Thomas E. Selfridge; and that, in all matters requiring the unanimous consent of the members, the consent of the said representative of the late Thomas E. Selfridge shall be required.

(2) Resolved: That the Association recognize Mr. Edward A. Selfridge of 2615 California Street, San Francisco, California, as the legal representative of the late Thomas E. Selfridge.

The above resolutions (1 and 2) were adopted by the unanimous votes of the surviving members, Messrs. Bell, Curtiss, Baldwin and McCurdy.

The following resolutions (3 and 4) requiring the unanimous consent of all the interests involved were then adopted.

(3) Resolved: That the Aerial Experiment Association be continued under its present organization for another period of six months, ending March 31, 1909.

Unanimously adopted, T t he vote of Mr. Edward A. Selfridge being accepted as the vote of the late Thomas E. Selfridge

(4) Resolved: That Mr. Charles J. Bell, President of the American Security & Trust Company, be appointed Trustee of the Aerial Experiment Association to receive and distribute the proceeds of the work of the Association in accordance with the article of agreement of organization, and of resolutions of the Association.

Unanimously adopted, the vote of Mr. Edward A. Selfridge being received as the vote of Thomas E. Selfridge deceased

Mr. Edward A. Selfridge gave his consent to the publication, outside of the Association, of an article written by the late Lieut. Thomas E. Selfridge entitled, “A Brief Sketch of the Progress of the Art of Aviation”, which appeared in Bulletin No. II issued Monday July 20, 1908; and Mr. Octave Chanute kindly consented to revise the article before publication as to data and references but not as to the sense of the article.

The following resolution was then moved by Mr. Curtiss seconded by Mr. Baldwin:—

(5) Resolved: That the official headquarters of the Association be removed from Hammondsport, N.Y., to Beinn Bhreagh, Near Baddeck, Nova Scotia, on the first of October, 1908. Unanimously adopted.

Letter from Mauro, Cameron, Lewis & Massie .

To Dr. A. G. Bell, Washington, D.C.

Washington, D.C., Sept. 24, 1908 :— Will you please forward to us a copy of the dictation from which you read last night, differentiating the A.E.A. structure from the Wright machine, as Mr. Cameron feels that the same will be of great value to him in preparing the specification of the case which he has in hand.

(Signed) Mauro, Cameron, Lewis & Massie.

Reply by Dr. Bell .

To Mauro, Cameron, Lewis & Massie, 620 F Street, Washington, D.C.

Washington, D.C., Sept. 29, 1908:— I have been looking over the patent of the Wright Brothers, No. 821, 393, May 22, 1906 to see how our method of lateral control differs from theirs. I give you a few thoughts upon the subject which may perhaps be of assistance to Mr. Cameron in preparing our specification of the case. At the same time this note will answer your note of September 24th as it contains the substance of the dictation you refer to besides other points.

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Difference between the Wright Brothers Machine and our Hammondsport Machines .

1. The framework of the Wright Brothers machine is flexible, ours is rigid.

2. It is a necessary feature of their machine that the framework should be flexible in order to permit of distortion, so that the aeroplanes may be twisted in accordance with their method of lateral control.

In our machine the framework is a stiff and rigid truss, specially designed to resist distortion and twisting strains; and we do not, and cannot, twist our aeroplanes, or distort the framework upon which they are stretched.

3. In the Wright Brothers machine, in operating the lateral controls, each aeroplane is given a twist along its entire length, so that each aeroplane surface is given a helicoidal warp or twist; and this kind of action is preferred by them for the reason that it gives a continuous surface on each side of the machine which has a gradually increasing or decreasing angle of incidence from the center of the machine to either side.

In our machine we have no kind of action at all analogous to this. We do not twist our aeroplanes, or any portion of them, for any purpose whatsoever: Indeed we look upon this kind of action as distinctly detrimental from a structural point of view; and our form of truss is specially designed to prevent it.

4. In the Wright Brothers machine the twisting of the supporting surfaces does not fully accomplish the result at which 10 2 they aim. They require to combine, with the twisting action of the aeroplanes, a steering movement of the vertical rudder at the rear.

Our lateral rudders by themselves accomplish the desired result without any co-operation with the vertical rudder.

This seems to be an important point of difference worthy of elaboration. The Wrights say (page 4, line 16 to 35).

***When the lateral margins of the aeroplanes are so turned in the manner herein before described as to present different angles of incidence to the atmosphere that side presenting the largest angle of incidence, although being lifted or moved upward in the manner already described, at the same time meets with an increased resistance to its forward motion, and is therefore retarded in its forward motion, while at the same time the other side of the machine, presenting a smaller angle of incidence, meets with less resistance to its forward motion and tends to move forward more rapidly than the retarded side. This gives the machine a tendency to turn around its vertical axis, and this tendency if not properly met will not only change the direction of the front of the machine, but will ultimately permit one side thereof to drop into a position vertically below the other side with the aeroplanes in vertical position, thus causing the machine to fall.

This is a confession by the Wrights themselves that the twisted aeroplanes do not accomplish the object they had in view. They require to include another element (the vertical rudder) in their combination in order to obtain our result. They say (p. 4, line 54 to 64).

***We do not limit ourselves to the particular description of rudder set forth, the essential being that the rudder shall be vertical and shall be so moved as to present its resisting-surface on that side of the machine which offers the least resistance to the atmosphere, so as to counteract the tendency of the machine to turn around a vertical axis when the two sides thereof offer different resistances to the air.

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3 5. The expression “when the two sides thereof offer different resistances to the air” suggests the idea that perhaps under some circumstances the two sides might not offer different resistances to the air in which case the assistance of the vertical rudder would not be required: It is only “when” they do so that it is needed.

The language of the specification is thus somewhat misleading; for a little consideration will show that the twisting of the aeroplanes to any practicable extent is incapable of producing the righting effect desired, without at the same time causing the two sides of the machine to offer different resistances to advance through the air:— The vertical rudder is an essential element in their combination. A little further discussion of the point will demonstrate this proposition.

6. The word “aeroplane”, as used in the Wright specification, is defined to mean “the supporting-surface or supporting-surfaces by means of which the machine is sustained in the air”

Now it is obvious that the machine will not be sustained in the air unless the air pressure is greater below the supporting-surfaces than above. The necessary condition of support is that the upward pressure from below must exceed the downward pressure from above, by the weight of the machine; otherwise the machine will fall.

This means that the aeroplanes that sustain the machine in the air must be tilted up in front, at a positive angle to the line of advance, so as to permit of an excess of air pressure from below. Even though it might be structurally possible to depress the front edge below the line of advance, 12 4 at a negative angle, it would not be practicable so to do; for the aeroplane, robbed of its support below would fall, and the excess of pressure acting upon the upper surface of the aeroplane would still further hasten its fall. The aviator who should twist his aeroplane to the extent of making a negative angle with the line of advance would speedily find himself in the position of Pat when he sawed off from the tree the branch upon which he sat.

So long as the instrumentalities involved in the twisting process are the "supporting-surfaces that sustain the machine in the air", it is obviously impracticable to turn the surfaces at either end so as to make a negative angle with the line of advance; at both sides the angle must be positive: That is, the surfaces must be tilted up in front at both ends. It is only practicable therefore to twist the aeroplanes sufficiently to present a different angle of incidence to the air at the two ends, both angles being positive. The side having the greater angle of incidence will experience more resistance to advance than the other; and thus produce a tendency to rotate about the vertical axis of the machine, necessitating a contrary steering action of the vertical rudder to prevent disaster. The vertical rudder is therefore an essential element in the combination of instrumentalities employed by the Wrights.

In our machine it is not so and for the following reason:—

The surfaces employed in our lateral rudders do not form any part of "the supporting-surfaces that sustain the machine in the air", and hence can be turned at a negative 13
5 angle to the line of advance without robbing the whole of one side of the machine of support, which would be the result of twisting one side of the Wright's aeroplane to a negative angle.

When our machine advances through the air, say upon a horizontal path, the lateral rudders themselves are horizontal. Their surfaces are parallel to the line of advance, not tilted up in front as in the case of supporting-surfaces. They are not, normally, supporting-surfaces at all; being merely appendages driven edgeways through the air.

In operating the lateral rudders the rear portion of one rudder is depressed, and the rear portion of the other elevated, and to an equal extent. The angles of incidence, one positive and the other negative, are equal; and the resulting resistance to onward advance is the same at either side of the machine, so the operation of the rudders does not tend to turn the machine about a vertical axis, but permits it to continue its t r ectilineal path without disturbance while the rudders perform their proper function of righting the machine after a tip.

Even though it should be held that the twisted aeroplanes of the Wright Brothers machine act as lateral rudders, or are lateral rudders themselves in effect, still it is obvious that they are not the equivalents of our lateral rudders, for an additional element is required in the Wright combination (the vertical rudder), to produce our result.

While the twisting of the aeroplanes is the method preferred by the Wright Brothers, and the only method shown 14 6 by them, their specification declares that their invention is not limited to this particular construction, but includes (p. 3, lines 41 to 45)

“Any construction whereby the angular relations of the lateral margins of the aeroplanes may be varied in opposite directions with respect to the normal planes of said aeroplanes”.

Again they say (p. 5 lines 74 to 76)

“Our invention is not limited to this form of construction, since it is only necessary to move the lateral marginal portions etc”.

Moving the “lateral marginal portions of the aeroplanes” is then the essence of the Wright method. The one essential ingredient of their combination. If we do this we infringe their patent according to their own declaration. But if we do not, do we infringe? Here we have the utmost scope of their invention defined in their own words; and yet it seems to me they do not cover our case.

In our machine we do not move “the lateral margins of the aeroplanes” at all; and could not move them, even if we so desired, on account of the rigid nature of the trussing employed.

Of course we must anticipate an attempt to show that our lateral rudders are the lateral margins of the aeroplane.

I think we may hopefully assume the position that our lateral rudders, so far from being the lateral margins of the aeroplanes, are not even “aeroplanes” at all in the sense that term is employed in the Wright specification. Of course they are substantially flat surfaces: But they are not “the supporting-surfaces by means of which the machine is sustained 15 7 in the air”: They are not “portions” of those surfaces whether “marginal” or not: They are not “supporting-surfaces” at all, for their surfaces are normally parallel to the line of advance, and are normally driven edgeways through the air without being inclined at an angle (or rather their angle of incidence is zero), whereas a positive angle of incidence, however small, is necessary to bring about “support”. I think we can show clearly that our lateral rudders are quite distinct from “the lateral margins of the aeroplanes”, by exhibiting the scope of our invention and dwelling upon cases which could not by any possible reasonable construction be declared to be covered by the expression, “the lateral marginal portions of the aeroplanes”.

Our lateral rudders are mere appendages which may be placed in any convenient location in the machine so long as they are oppositely or symmetrically arranged on either side of the longitudinal axis of the machine.

We prefer to place them beyond the lateral end of the aeroplanes so as to obtain as great a leverage as possible: But they may be placed between the aeroplanes, in front of them or behind them, above them or below them, in fact their exact location is immaterial to their mode of operation.

We might even have a series of such rudders arranged radially, like the vanes of a wind mill, around the longitudinal axis of the machine. (see diagram). This is a most interesting case, suggesting the advisability of avoiding the use of the word “lateral”.

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8 Some of these rudders could hardly be considered as lateral rudders. Take the vertical pair for example (ab).

The function of our rudders (“balancing rudders”?) is to turn the machine around a longitudinal axis as desired, without turning it around a vertical axis.

Any two of these opposed vanes would do the work. Take for example the vertical pair (ab) in which the surfaces, as in all the other cases, are normally parallel to the line of advance being driven edgeways through the air. Here, however, the surfaces are normally vertical instead of horizontal.

Now when we move these vertical rudders (ab) to one side, are we moving “the lateral margins of the aeroplanes”? Assuredly not.

Here it is obvious to the blindest eye that we are dealing with a different thing altogether. ? B ut the operation of the vertical pair (ab) does not differ in principle from that of the horizontal pair (cd) which constitute, substantially, the rudders we use.

I am decidedly of the opinion that our invention is not covered by the Wright Brothers patent. If we can only grasp, and express, the essential features, I am inclined to think we may obtain an independent patent of value which will not be subordinated to the Wright Brothers patent in any respect.

(Signed) Alexander Graham Bell.

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A Note by Mr. Edmund Lyon .

Washington, D.C., Sept. 29, 1908 :— The Wright Brothers in their lateral control rely wholly upon varying the support of different portions of their aeroplane by means of a twisting feature. All parts of the plane necessarily retaining more or less of their lifting power. The total amount of lift in their plane being variable when the medial axis maintains a constant angle to its vertical axis.

In the Hammondsport idea, however, the amount of lift is unchanged by any action whatever of the lateral rudders. When in normal position the lifts of these rudders are both zero and when in operation the resultant effect of the two rudders will be zero, the positive effect of one being exactly counterbalanced by the effect of the other. The lift of the entire plane will not for one instant be increased or decreased by any action whatever of these lateral rudders.

The Wrights idea changes constantly the lifting power of their machine, whereas the Hammondsport idea leaves the lifting power invariable.

(Signed) Edmund Lyon.

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WORK OF BEINN BHREAGH LABORATORY: by William F. Bedwin, Superintendent.

Aerodrome No. 5 .

Aerodrome No. 5 has now begun to look like a real flying machine. The beading of the machine is practically completed and its weight, as it is suspended from the ceiling of the Aerodrome shed is 160 lbs. It contains 3690 winged cells assembled in the manner shown in photograph (Bulletin No. IX, pp 31–32). The center section is not in the machine. Appended is a photograph of the best view we could get of the machine in the Aerodrome shed, it being very inconvenient to remove it to the outside in its present condition.

The full-sized model of the center sectiqon of aerodrome No. 5 has been completed with its metal fastenings etc., and is suspended in a frame at the Kite House for study purposes. The weight of this center section, photograph of which is shown in Bulletin No.XI p. 25 is 54.5 lbs.

Material for guy wires, turn buckles etc. etc., has been ordered from Hammondsport and is expected here daily.

Aerodrome No. 6 .

CORRECTION :— I would like to correct two errors that appeared in Bulletin No. XII in relation to the eight foot pitch, double propellers used on the Dhonnas Beag. These propellers are 7 ft. diameter instead of 6 as stated, and the new double propellers which have a pitch of 30 degrees at tip 19 2 are 2.28 meters diameter instead of 2.08 as stated.

On Sept. 29, 1908, an experiment was made with these new double propellers, which are now mounted on the Dhonnas Beag geared 8–40. The following results were observed: — Maximum pull 107 lbs., steady pull 90 lbs; rotation of engine 695 in 30 seconds, giving a rotation of propeller of 1390 rpm. In this experiment the engine turned up very nicely. No run was tried over course as I thought this part of experiments should be deferred until Mr. Baldwin returned. A description of the construction of these propellers is given in my report, Bulletin No. XII p. 15. Photographs of the propellers separately, and on reverse gears, and mounted on the Dhonnas Beag are appended.

The model for aerodrome No. 6, Oionos type, is complete so far as the oblique surfaces are concerned. It is composed of one meter tetrahedral cells covered with nainsook, these cells are made up of the 50 cm triangles referred to in Bulletin No. I, p. 31, and interlace one another in single Oionos form as shown in appended photograph. On account of the unfinished condition of structure, it was necessary to photograph upside down. At the points of inter-section of these cells there are thirteen horizontal surfaces inserted each 50 cm by 50 cm. On the top of the structure is will be placed a horizontal surface 7 meters long by 1 meter wide, making a total horizontal surface of 10.25 square meters. No attention has been paid as yet to putting on body part of machine. I thought it better to go ahead and build the whole wing structure, and then cut out a portion of the center to insert body. My reason for doing 20 3 it in this way was, that I could get the whole material lined up more truly and at the most, all I will have to cut out will be one 50 cm inverted cell, and a square surface 50 cm by 50 cm.

The wooden members of this construction are made very light only 8 millimeters by 4 millimeters in cross-section. It is proposed to strengthen these members by a system of wiring suggested by Mr. Baldwin.

I have found considerable u d ifficulty in keeping the Dhonnas Beag perfectly water-tight, and discovered that in carrying it in and out of the building, we have started cracks in the planking due to the strains of lifting it in and out of the water. Considering this I have thought it better to make a cradle to set the boat in, and have placed a set of rollers on the platform and floor so that it can be run in and out without any undue strains to the hull. I think this will be more satisfactory than the old way of launching.

I have written to a Boston firm asking quotations on cedar planking 3/16 of an inch thick to be used for the boat part of aerodrome No. 6. I think this material will be much lighter and better for the purpose than the cyprus used in the Dhonnas Beag.

The double pro ? p ellers on the Dhonnas Beag weigh only about 8 lbs each, and are remarkably stiff and strong.

Appended is a photograph of a propeller being made at the Laboratory by Mr. C. McLean. It will be noticed that one blade is expanded and one contracted. It is proposed to have this fitted so that the blades can be expanded during rotation. W. F. B.

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ON THE DEATH OF SELFRIDGE.

(Extract from letter from Mrs. Bell).

? B addeck, Nova Scotia, Sept. 20, 1908:— I can't get over Tom's being taken. I can't realize it, it doesn't seem possible. Isn't it heart breaking? Yet and yet it is better for him than to die as poor Langley did. He was so happy to the very end. I know he would have said he was having the time of his life, and though he must have realized his danger in those last seconds, he would still hope to escape, and he had no time for unavailing regrets. It was the happiest way death could come to him now, but why need it have come now when he was ready to put to his country's use all the results of his long patient preparation.

I feel I never realized how dear and good he was. I find all the old women here heart broken for his dear sake, he was so good to them, and what higher testimonial could a young fellow have. How few will turn aside in their gay happy lives and full interests to be kind to the broken old women with nothing attractive about them, but that they were women and he a knightly boy.

I miss the thought of him so. Nobody ever did so many little things for me as he. Others have loved me more of course, but he just saw the little things, pushing up my chair at table, or bringing a screen to shut off a draught, all so quietly and unobtrusively no one noticed.

I am so sorry for you in this breaking of your beautiful Association. But it was beautiful and the memory of it will endure:—“Bell, Curtiss, Baldwin, Selfridge, and McCurdy”. 28 2 It was indeed a “brilliant coterie” as one paper said. Do anything you think best, but let the A.E.A be only those to the end, and then take some other name.

Give my love to them all, and let's hold tight together all the tighter for the one that's gone. Casey called me the “little mother of us all”, and so I want to be; I love all our boys, and there can't be any others just the same, etc.

(Signed) Mabel G. Bell.

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Bell to Curtiss .

Mr. G. H. Curtiss, Hammondsport, N.Y.

Washington, D.C., Sept. 29, 1908 :— I notice in the newspapers this morning that the Wright Brothers have applied through their sister, Miss Wright, for an extension of time on their contract amounting to about nine months.

While the War Department is inclined to favor this extension it is disappointed that the Officers of the Signal Corps should be deprived for so long a time of the opportunity of experimenting with heavier-than-air flying machines. Through Wilbur Wright, the Officers of foreign armies will be able to gain experience in the use of such machines; whereas in our own army we must await the recovery of Orville Wright, or the return of Wilbur Wright to this country.

Now why cannot the Aerial Experiment Association offer its services at this juncture? We are not in any sense competitors of the Wright Brothers in the matter of their contract with the Government. We are an experiment association, pure and simple, carrying on experiments to promote the art of aviation in America. One of the reasons for associating

Lieut. Selfridge with us was that the United States Army should have the benefit of our experiments through an Officer specially detailed to observe them. We now have two aerodromes (No.3 and 4) ready to fly, and why should we not offer the War Department the use of these aerodromes for experimental purposes while they are waiting for Orville Wright to recover. If you and the other members of the A.E.A think well of this idea telegraph to me upon receipt of this at once, and I will invite Major 30 2 Squi e r s to go to Hammondsport and look over our machines, or detail an officer to report upon them, and express to him our desire to be of assistance to the War Department in this matter without in any way interfering with their dealings with the Wright Brothers. I can say that we are their friends, and not their competitors, and will not do anything that would interfere with their contract with the Government.

I suppose you are now starting on some flights with the June Bug to show Casey the advance you have made in gaining skill in the manner of its operation. There is only one thing I am afraid of in regard to these experiments, and I had quite a serious conversation with Douglas McCurdy about it. The temptation is strong to attempt to carry two men in the June Bug, or in the Silver-Dart, because Orville Wright, Wilbur Wright and Farmam or Delagrange have done it. I do not want you, or any of you to attempt it. It has already been done by others and of course we know that we can do it too, but I do not think that we have any right to run unnecessary risks and am not at all in sympathy with the idea, as it cannot advance our experiments, and it might be possible that we might regret it. Orville Wright, the most experienced aviator of the world, and probably the best, has lost poor Selfridge. Do not let us, with less experience, run any risks of this kind. Nothing can be gained by it, and the weight of another man — a mere mass of lead, and not a living human being, would serve just as well to demonstrate the capabilities of our machine. We would justly lay ourselves open to severe 31 3 criticism were we to make such an experiment without adequate reason for so doing. I cannot speak too strongly on the matter. Remember Selfridge.

Yours sincerely, (Signed) Alexander Graham Bell.

TELEGRAPHIC REPLY TO ABOVE .

(Curtiss to Bell)

To Dr. A.G. Bell, Parker House, Boston, Mass.

Hammondsport, N.Y., Oct. 1, 1908 :—Casey and Gardiner arrive Boston Friday morning. Think well of your idea. All here with you in any action you take.

(Signed) G. H. Curtiss.

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Bell to President Roosevelt .

To The President of the United States, White House, Washington, D.C.

Baddeck, N.S., Oct. 5, 1908 :—The death of Lieut. Thomas E. Selfridge, in the recent accident to the Wright Brothers flying machine, has deprived the United States Army of the services of the only officer acquainted with the work of the Aerial Experiment Association of which I am Chairman.

On behalf of the Association therefore, allow me to say, that we shall be very glad to give any information concerning our work to some other officer of the U S Army if desired.

We have, at Hammondsport, New York, an aerodrome available for experimental purposes, which won the Scientific American Trophy July 4, 1908, by flying one kilometer in a straight line.

We have another improved aerodrome upon the same model which is expected to take the air in about two weeks at Hammondsport, New York.

We have also at Beinn Bhreagh, Near Baddeck, Nova Scotia two other aerodromes partly completed, of entirely different construction which will probably be ready for trial in the early part of November.

We shall be glad to submit all these aerodromes, and the whole past work of the Association, to any officer properly detailed by the War Department, and afford him every opportunity for making experiments with our machines.

(Signed) Alexander Graham Bell Chairman of the A.E.A.

33

WHAT THE WORK OF THE AERIAL EXPERIMENT ASSOCIATION MEANS by Carl Dienstbach.

When the first Hammondsport motor-aeroplane was built, the greatest achievement in power-flight before the public was the Voisin-Farman machine. It was therefore most natural to build the " R ed Wing" on similar lines. There was indeed no true "rear cell" in the first construction, but the horizontal-vertical "wea ?? th er-vane" behind, very soon developed into a regu a l ation "cell". While the "Red Wing" contained indeed virtually every part of the Farman machine, it still was superior. The "tail" in the rear cell was much smaller in proportion, and rectangular instead of forming a cube, and there was no dihedral angle — that imperfect method of maintaining side equilibrium.

The "Specialty" of all Hammondsport machines, vise-curving the wings toward each other at their tips, while originally only an archi-tectonic feature, that means, adapted only in the interest of a specially strong and light pattern, embodied at the same time two important aerodromical advantages.

Its natural consequences was a narrowing of the wings toward the tips. Lilienthal first explained scientifically how this increases the efficiency of the surface as a whole in “narrowing the supporting air wave at its lateral margins, and preventing it from breaking up into eddies at the sides”.

It also tended to facilitate turning, as it became instructively evident to everyone who had seen Farman's machine fly after the “June Bug”.

34

2 But it not only increased the efficiency of the surfaces but also the lateral stability. A little reasoning will show that it shielded the marginal portions of the wings from being lifted by the air current unless it came straight from the front . The effect of side gusts was thus minimized from the outset.

Moreover: The effect of shoving the machine sideways, which might be expected to some slight degree from a side gust striking the “spindle-shaped” body represented by the side elevation of the machine, tended further to decrease the excess of lift (one the side first struck) it would have produced in machines of the ordinary type.

The reason is very clear: The machine would thus yield to the impulse, and that means, that its lift, in this sideways sense, would be diminished in much the same way as that of a kite of which the flying line has been severed, and which is receding before the wind. Also this yielding of the machine might cause a certain compensating “pseudo-wind gust” from the opposite side at the moment of the first impact, as the machine might be itself pushed sideways against air, which, in the lateral sense, was yet “still” during the first instant.

In the “Red Wing” the upper wing-tips overlapped the lower, and there was therefore more down-bent tip-surface than compensating up-bent one. The effect was therefore like having a plane with down-bent tips, and it is known, that this shape is really the best for side equilibrium, for the simple reason that a side gust which naturally tends to lift the side it strikes is neutralized by the downward pressure it exerts at 35 3 at the same time one the down-bent side tip. This is no mere theory, but the outcome of practical experience with the Wright gliders. So even the “Red Wing” possessed evidently a high degree of automatic lateral equilibrium.

The excellence of the tip-control since introduced and its superiority in not producing any one-sided drift and not requiring any compensating action of the rear rudder, over the Wright Brothers tip-control is evident. It is also, in the last machine the “Silver-Dart”, fully as powerful as the Wright's device. What the moveable tips may comparatively lack in surface, is made up by their greater leverage, being disposed at the ends of longer and narrower wings.

It is most significant fo t r the keen judgment which has controlled the Hammondsport experiences, and which has so fully made the best of its experiences, that the Wright Brothers views about the fallacy of seeing in a rear cell a really beneficial stabilizer under any but exceptional conditions, were arrived at independently.

Similarly it was found, that the horizontal front rudder, as well as the vertical rear rudder had to be powerful and capab e l e of exerting a very strong effect in emergencies.

The outcome of the development gone through in three tentative constructions seems, that aeroplane No. 4, the “Silver-Dart” has become a machine which reaches fully the level of the Wright flyer.

There might be unfinished points: The exact proportions of the leverage in the rudders to their surface and to the measurements and proportions of the whole machine might not yet have been hit. There might be avoidable dead resistance in 36 4 part of the framing (front control support). There may still be imperfections in the shaping of details (front ends of wings etc.) in which all the Wright Brothers ha d a larger experience to guide them; but there seems a superiority in the way the controlling devices are operated (the latter all act independently from each other and are put in action by seemingly more convenient and natural means, steering wheel, fork around body, etc) to fully make up for that all.

So it seems perfectly true, that a man, with sufficient skill to make record-breaking flights with the Wright machine, might do at least fully as well with the tailless, tip-controlled, powerfully steered, reliably-motored “Silver-Dart”; and a splendid future lies before the Hammondsport experimenters.

It must not be forgotten moreover, that they attain so far their achievements under rather adverse conditions of the testing grounds.

(Signed) Carl Dienstbach.

BULLETINS OF THE Aerial Experiment Association

Bulletin No. XIV Issued MONDAY, OCT. 12, 1908

ASSOCIATION COPY.

BEINN BHREAGH, NEAR BADDECK, NOVA SCOTIA

BULLETIN STAFF .

Alexander Graham Bell Editor.

Gardiner H. Bell Asst. Editor.

Charles R. Cox Typewriter.

Mabel G. McCurdy Stenographer.

Bulletins of the Aerial Experiment Association .

BULLETIN NO. XIV ISSUED MONDAY OCT. 12, 1908 .

Beinn Bhreagh, Near Baddeck, Nova Scotia .

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1

Editorial Notes and Comments .

The work of the Aerial Experiment Association was suddenly interrupted on the 17th of September, 1908, by the lamentable death of Lieut. Selfridge in the accident to the Wright Brothers flying machine at Washington, D.C.

On Friday, Sept. 18, the Chairma a n accompanied by Mr. F. W. Baldwin, left Baddeck for Washington where they arrived Sunday, Sept. 20, and were joined by Mr. G. H. Curtiss and Mr. J. A. D. McCurdy from Hammondsport, N.Y.

On Monday, Sept. 21, a meeting of the Aerial Experiment Association was held at 1331 Connecticut Avenue, Washington, D.C.

Mr. McCurdy was elected Secretary of the Association, and resolutions were passed relating to the death of Lieut. Selfridge, and a resolution of sympathy for Mr. Orville Wright.

On Friday, Sept. 25, Lieut. Selfridge was laid at rest in the Natio a n al Cemetery at Arlington, Virginia; He was given an impr r e ssive military funeral. Three volleys were fired over his grave by his comrades in arms, and the ceremonies terminated with the bugle call “taps” or “put out the lights”.

The Honorary pall-bearers represented the Army and Navy the Aerial Experiment Association, and the Aero club of America.

For the Army appeared Major Squier, Acting Chief Signal Officer, and Lieut. Winter of the aeronautical Dept. of the Army For the Navy appeared Lieut. Creecy of the U S Marine Corps reprsenting the aeronautical Dept. of the Navy.

The Aerial Experiment Association was represented by Alexander Graham Bell, Chairman, Mr. F. W. Baldwin and Mr. J.A.D. McCurdy (Mr. Curtiss was unable to attend).

2

2 the desire to publish the whole work in parts in his Magazine. I stated that there was no objection on the part of the Association to the republication of this article, but that of course it would be necessary for him to obtain the consent of the author himself. Before he could do so the accident to the Wright Brothers flying machine occurred, and he was unable to obtain the permission of the author, although I am sure that Lieut. Selfridge would have been only too glad to give his consent had he known of the correspondence.

I have just received the following note from the Editor of Aeronautics refer r ing to the matter:—

COPY . AERONAUTICS, Broadway and 57th Street, New York. New York, Sept. 30, 1908 Dr. Alexander Graham Bell, Hammondsport, N.Y. Dear Dr. Bell:—

Referring to Lieut. Selfridge's as to Aviation, would it be proper to publish this history in the Magazine? The City Editor of the Philadelphia Inquirer has asked me to beg the same privilege from you for his paper, and if permission is granted, I would furnish him with the copy. I have made a copy of the history, and will return your copy to Nova Scotia.

Please accept my sincere thanks for the privilege of seeing this, and trust there will be no objection to printing it, as I know of no other work that is as concise, and, at the same time, complete as this.

(Signed) E.L. Jones.

Of course it would be possible for us to have the volume printed without any expense to us by taking advantage of the request from the Editor of Aeronautics. He w c could print 3 3 it in parts in his magazine, and give us a number of copies to be bound up in book form for presentation to personal friends of Lieut. Selfridge, and to public libraries. The only question is whether the printing and illustrations would be sufficiently good for our purpose. The illustrations that appear in Aeronautics are not of the best, nor indeed does the paper used in the Jour r n al admit of very fine reproductions. There is another consideration, the volume would be sufficiently important to be presented to the public through a suitable publisher; a large number of copies could undoubtedly be sold. I propose to write to the Editor of Aeronautics requesting him to take no action in the matter until we have considered fully what to do.

My present idea is to submit the manuscript to Mr. Chanute for correction, and make a collection of photographs to illustrate it. We would then publish the book and present the copyright to Mr. E. A. Selfridge. We could allow “Aeronautics” to reprint the article in parts at their own expense, or do the printing for us if the Editor will use such quality of paper as we approve. We could supply him with plates to make suitable illustrations and make an arrangement with him by which we could pay a portion of the expenses in order to secure a satisfactory publication. This would be cheaper for us than if we were to assume the whole cost of publication ourselves. The plan would also assist the Journal “Aeronautics” and it is certainly consistent with the objects of the Association to give a helping hand to such a Journal during its period of infancy. I should be glad to hear the views of the members of the Association individually regarding the suggested memorial to Selfridge. A.G.B.

4

McCurdy to Mrs. Bell .

To Mrs. A. G. Bell, Baddeck, N.S.

Hammondsport, N.Y., Oct. 2, 1908 :— About Mr. Bell coming to Hammondsport:— The “Silver-Dart was all ready absolutely, all but the engine which is well under way, and we expect to start flying within two weeks time at the outside.

Now Mr. Bell said that he would like to come here, if we were all ready to fly at once, but as we were not, there really was nothing for him to do except look at the machine. He was awfully nice about it, and said that he would come if he could be of any use to the game and us, but as it would only mean looking at the structure and going away, and the structure was in general lines, the same as he had already seen he thought that would go right through to Baddeck.

He decided at the last to stay over (in Washington) and help out Mrs. Hubbard with her reception; so Casey and Gardiner came on to Hammondsport with Glenn and myself.

Casey wanted so much to fly. We had hard luck all round and poor Casey didn't get in the air. Howver that is nothing. It has happened lots of times before with all of us. E I t was so nice being all together again and talking with each other. The pleasure was only marred by one thing and that was the absence of old Tom.*** The weather here is getting pretty bad for flying all the time. Winds blow almost every day. We are staking a lot on the ”Silver-Dart's future with a new engine. It will be such a satisfaction to have the engine maintain its power indefinitely so that you can come down only when you want to. Casey and Gardiner left for Boston yesterday J.A.D. Mc?

5

BALDWIN'S EXPERIMENTS WITH HYDROPLANES, OCT. 6, 1908: By Gardiner H. Bell.

<u>Exp. 1</u> . On Oct. 6, the Dhonnas Beag was tried out with the new propellers. Each of these propellers is 2.28 meters in diameter with a pitch of 30° at the tips. The boat was tried on the regular 100 meter course with the following results:—

100 m in 15 sec down

<u>100 m in 19 sec up</u>

200 m in 34 sec

In the above experiment no hydroplanes were used.

Exp. 2 . We then put on three sets of hydroplanes each set of four blades inclined at an angle of about 10°.

FRONT

SIDE

The speed in this case was:— 100 m in 26 sec down.

In trying to turn at the lower end of the course, the rudder became disabled and the Dhonnas Beag had to be towed home. Throughout the experiment the wind, which was light, blew down the course.

It may be seen that the hydroplanes were anything but satisfactory, but it is hoped that the new ones which are to be constructed on a different plan, will give successful results i.e., increase the speed instead of diminish it.

6

2 Exp. 3 . After repairing the rudder another experiment was tried in the afternoon with the same outfit. The boat had no more than gotten headway when the taper pin clinching the sprocket to the propeller shaft, was sheared off. This ended the experiments for the day.

It may be stated that the trial with hydroplanes was purely an experiment, and that after familiarizing ourselves with the subject we shall undoubtedly attain better results. G.H.B.

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BALDWIN'S EXPERIMENTS WITH HYDROPLANES, OCT. 8, 1908: by Gardiner H. Bell.

On Oct. 8 the Dhonnas Beag was tried out in view of gaining more knowledge of the hydroplanes, and the following results have been reported:—

Exp. 1 . Double propellers were used throughout the experiments, 2.28 meters diameter, and 30° pitch at tips, with the following result:—

100 meters in 24 sec.

At this point the engine acted badly, and a non-vibrating coil was connected up in place of the former one. In above experiment two front hydroplanes alone were used, causing the boat to lift out of the water forward about four inches.

Exp. 2 . Same outfit as with experiment 1 with a result:—

100 meters in 25 sec down.

100 meters in 39 sec up.

200 meters in 64 sec

Exp. 3 . The forward planes were taken off and the after ones put on, with a result:—

100 meters in 24.5 sec down.

The boat still did not steer well and was towed back.

Exp. 5 . Then an experiment was made to try and ascertain the lift of the hydroplanes. The boat was lifted out of the water, in the rear about three inches (as in Exp. 3) by means of a spring balance attached at the point where the hydroplanes were. The balance registered 75 lbs. Hence in experiment 3 the hydroplanes had an approximate lift of 75 lbs.

G.H.B.

BALDWIN'S EXPERIMENTS WITH HYDROPLANES . By A. G. Bell.

Mr. Baldwin is rather disappointed with the results so far obtained with the hydroplanes he has employed on the Dhonnas Beag. Without the hydroplanes the boat makes a speed of about 15 miles an hour; with the hydroplanes this speed is cut down about one-half without much apparent indication of lifting the boat; so that under the present arrangement the boat is impeded without any counterbalancing advantage.

Mr. Baldwin thinks that there is no reason why we should not obtain results comparable to those obtained by Forlanini. We do not, however, know precisely the dimensions and arrangement of the hydroplanes used by him. We only have the idea of a Venetain Blind sort of arrangement under water.

The hydroplanes used by Mr. Baldwin consist of blades of iron about 25 × 4 cm, and about 3 mm thick. There are three sets, each set consisting of four hydroplanes. The total surface of the submerged hydroplanes is therefore about 1200 sq. cm.

When the frames are vertical the hydroplanes make an angle of 5° with the horizontal as in Fig. 1. When the frames are sloped forwards as shown in Fig. 2 the hydroplanes make an angle of about 10°. The encouraging feature of the experiments so far, is that the speed of the boat is markedly greater with the hydroplanes at five degrees than at ten. This shows that the hydroplanes are producing some sort of effect, at least so far as drift is concerned; and it is reasonable to suppose that there is a corresponding effect upon lift even though we 9 2 have not the means of measuring it. It is to be noted, however, that the greatest retardation was observed when the framework was sloped forward as in Fig. 2, in which case there was a vertical component of pressure downwards offered by the vertical framework itself.

This suggests the thought that it might perhaps be advisable to slope the framework backwards as in Fig. 3, so that there should be an upward instead of downward component of pressure due to its resistance. This of course would involve changing the setting of the hydroplanes to prevent them from being inclined at a negative angle.

It might also be worth considering whether the sloped-back verticals might not alone be used as hydroplanes. The present hydroplanes have to be made of pretty thick material to stand the pressure upon them. Whereas, if the verticals were used as hydroplanes by being sloped backwards sufficiently (see Fig. 4) there would be better economy of material. The width of the planes extending from fore to aft resisting better the pressure of the water.

The front edges could be thickened instead of presenting a knife edge if desired, and the whole arrangement would be somewhat like a hay rake with blades instead of prongs. A.G.B.

10

FIG 1.

FIG.2.

FIG.3.

FIG.4.

FIG 5

FIG 6

FIG.7.

11

SAFETY: By A. G. Bell.

In the development of the Hammondsport machines a great deal of attention has been paid to the means of operating the various controls, The steering-wheel by means of which the front control and the vertical rudder are operated, and the body-fork for working the lateral controls are undoubtedly convenient; but comparatively little attention has been paid to the comfort and security of the operator.

I think it would be well to consider what changes might be advisable in the interests of safety in the event of a serious accident. At present the man is cramped into a small space with hardly room to move. The only provision for his safety in case of accident seems to lie in the large extension of the apparatus in the longitudinal and lateral directions. In making a bad landing one of these extensions comes first to the ground; and, by crushing gradually in, acts as a buffer to reduce the shock of alighting. The man is saved at the expense of the machine; and fragility of construction becomes an element of safety.

The tendency of development however, has been to save the machine from damage by increasing the strength of its parts; but every increase of strength involves increased shock to the man at the moment of landing. If the machine crushes in, the shock to the man will be slight; whereas if it does not break, or yield to the blow, the operator will experience the full effect of the shock.

12

2 In the interests of safety I would suggest that the operator should have something solid above him to hold on to, and room in front of him to swing forwards and upwards when the shock occurs, as the bob of a pendulum would do under similar circumstances.

A year or two ago a railroad train carrying American passengers from Liverpool to London was badly wrecked; and all the people in one of the cars were killed or injured, with the exception of one man, who saved himself by swinging freely from some part of the car with his feet clear of the floor.

Of course any application of the swinging principle to an aerodrome would involve a clear space in front of the man which would permit his body to swing forwards and upwards under the sudden shock of a bad landing.

This would involve a change in the arrangement of the steering gear; but on the principle of considering only one point at a time so as not to have the mind distracted by side issues which only tend to produce confusion of thought and vagueness of conception, we will for the moment avoid the consideration of what changes in the steering gear would be necessary or advisable, and limit ourselves to the central thought of swinging, for safety, in an emergency.

A simple holding-on strap like those found in street cars would be sufficient to materially decrease the chances of injury. A universal-joint arrangement like this would require free space, not only in front of the man, but around him, so that he should not be thrown against any part of the apparatus.

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3 It would be a comparatively simple matter to incorporate in an aerodrome a sort of trapeze bar for the operator to hold on to, and this idea seems to me the most practicable to form a basis for development.

In a practical aerodrome the center of gravity is in advance of the center of surface, so that when from any cause headway is lost, the machine tends to dive. Loss of headway was undoubtedly the cause of the dive that cost poor Selfridge his life. It is against the disastrous results of such a dive that the operator chiefly needs protection. So long as we have headway our various controls, which are really rudders, will operate; But all rudders are useless when headway is lost; and all our aerodromes under such circumstances are liable to dive. We should certainly give serious attention to the development of means for minimizing the danger to the operator.

In an aerodrome like the "June Bug", in which the front control is carried upon the end of an extension containing two parallel bars separated by a space there could be little difficulty in arranging a trapeze bar in front of the man at a convenient elevation across the longitudinal rods. 14 4 Or the man might sit upon a swing: The longitudinal bars for example, might afford support for a swinging seat arranged after the manner of parallel rulers.

This arrangement is capable of development in quite a number of interesting ways. At first sight the disadvantages seem to outweigh the advantages; but we will avoid the disadvantages and consider only the advantages, for that is the way to advance an embryo invention.

While it would never do to have a loose swinging seat alone, it is obvious that the man could brace himself against a fixed, rigid, foot-rest, and could further support himself by resting his arms upon the fixed longitudinal supports.

15

5 There are great possibilities of development here. It is obvious that the swinging seat could be connected by levers so as to operate the front control, or a horizontal tail, or both combined, in an automatic manner through the weight of the man. At the same time, the man, through the medium of his fixed foot-rest and the fixed supporting bars on which he rests his arms, would have full power of adjusting the position of his seat in any way he chooses. In fact a voluntary movement of his seat could be made his means of steering in a vertical direction up or down.

The automatic feature too may be of importance especially in an emergency when a man is apt to lose his head. Suppose the man to be seated on his swing, say with his arms folded and his feet clear of the foot-rest, then his weight would tend to keep the vertical supports of his seat in a vertical position. Now if from any cause the machine should dive, his seat would swing forwards under the influence of gravity, thus operating the front control automatically to steer the machine up. Or suppose that the machine from some cause should move upon an upgrade instead of pursuing a horizontal path the seat would swing backwards thus operating the front control automatically to steer the machine down. This automatic action, however, would not interfere with voluntary control of the steering gear by the operator himself.

In this way the coarse adjustments would be controlled automatically by gravity and the fine adjustments by the voluntary act of the operator himself. A.G.B.

16

CUTTING EDGES: By F.W. Baldwin.

Dr. Chanute suggested an improvement that could be made in our aero-surfaces of the Red Wing type which seems to have a very wide application to the general design of aerodromes or hydro-dromes.

His suggestion was to put the curved edge in front instead of the straight one as in our present arrangement.

The reason for this change is apparent and yet none of the machines we have at present are designed with a view to having slanting or curved cutting edges. A wedge naturally offers less resistance to the air than does a plane driven at right angels to the line of flight. A great deal of attention is paid to the cross section of struts etc. to insure a fair form, but none whatewver to the angle at which the strut itself cuts the air. The French expression “angle of attack” seems to express the idea better than the angle of incidence. Now why should all our cutting edges, whether of the supporting planes or of the truss itself, be presented at right angles, so as to offer their maximum resistance?

Take the case of a simple flat equilateral triangular glider. Compare its efficiency first with the apex as a cutting edge and then with one flat side as a cutting edge. It offers much less resistance (i.e., it is a more efficient glider) with the apex leading. In this case twice the length of cutting edge is presented to the wind at a cutting angle of 60° and it is more efficient than when one edge is presented at 90° to the wind. Of course there is a limit beyond which it would not be advantageous to reduce the cutting angle, but it seems to be 17 2 a case in which the two sides of a triangle are better, if not shorter than the third side.

Rushing off to nature to support our ideas by analogy is, I think, very apt to be misleading unless we have a clear idea of the object served by a certain feature, but as far as I know from a very limited knowledge of the shape of birds wings the cutting edge never is at right angles to the line of advance. From a hazy recollection it seems to me that wings fall under two classes in plan both of which have a slanting cutting edge. Propellers bear out the same principle. Modern practice in high speed water propellers has been to rake the blades back radially more and more why?

Why has Mr. Wright employed a propeller which is analagous to type (2) of the birds wing?

18

3 The best form of sails bears out exactly the same idea. Mr. William Fyfe one of the most successful designers in the world made a large number of experiments to determine the best shape for the headsails of boats and came to the following conclusion:—

Sail (2) with the long easy cutting angle was much more efficient in windward work than (1) although both sails have exactly the same area.

In the sail plans for ice-boats (which are more nearly comparable to the aero-surfaces of a flying machine) the shape of the sails with respect to the cutting edge is more fully appreciated.

19

4 On ice-boats the old lateen rig is very hard to beat in spite of its many disadvantages.

Wherever we look the angle of the cutting edge emphasizes its importance. We object to using wire one gauge larger than necessary or to its vibration, because of the increased head-resistance, and yet persist in driving the framework of the whole machine through the air in the worst possible way at right angles to the line of flight.

Trusses of the Red Wing type lend themselves easily to a greatly improved angle for the cutting edges with possibly some advantages in fore and aft stability. F.W.B.

20

THE SELFRIDGE MEMORIAL .

(Suggestions by Mrs. Bell).

The best way to make a permanent Memorial of Lieut. Selfridge is to publish his paper in such form that it would be attractive to, and therefore reach the largest possible number of those more or less interested in Aviation and in deeds of heroism.

Pamphlets to my mind are generally so much money wasted. In the first place they are very commonly thrown unopened into the waste-paper basket, even when opened and read with approval their preservation is a matter of difficulty owing to their shape, which is not adapted for bookshelves.

I would therefore suggest that the paper be published by some publishing house like The Century Company. The copyright is not it seems to me a matter of moment. Mr. Selfridge has sufficient means, and the A.E.A. is not proposing this as a pecuniary thing. With Chanute as Editor — a foreword from you — and with illustrations inserted in the body of the work — the index — and a good biogra b p hical sketch, and his photograph — also a photograph illustrating the work of Orville Wright with whom his name will always be associated — it seems to me we could produce something that would be widely distributed. I am premising of course that the paper is, as you say, of importance.

In regard to Aeronautics , I agree with you we should help it all we can, but in this case our chief object is the memorial to our comrade, and everything must be subordinate to that. Aeronautics might be allowed to publish it, but the publishing house should be consulted first. M.G.B.

21

THE LAUNCHING OF AN AERODROME: By Gardiner H. Bell.

At the present stage of the game there are three distinct ways of launching an aerodrome, namely, The Wright's method, which necessitates the use of a starting machine; the method of rising into the air on wheels used at Hammondsport, and elsewhere, and that of rising from the water.

It is easy to see that each of these modes of ascent has its difficulties. The first, because without the starting apparatus an ascension cannot be made; the second, because a long, level stretch is not always at hand, and the third, for the same reason and also because sufficient speed cannot be attained by the machine's own motive power, causing it to rise from the water. Though it has its difficulties, the third and last way is the safest, and if only for this reason, should be encouraged.

There is a scheme on foot which will embody three distinct phases in rising, caused by increase of speed. The machine is to be a combination of aeroplanes, boat, and hydroplanes It will commence headway as a boat, when headway is increased it will rise on its hydroplanes, insuring a still greater speed, in turn bringing into play the aeroplanes which will take it into the air.

G.H.B.

22

THE OUTLOOK ON AVIATION: by Gardiner H. Bell.

The following is a partial list of articles relating to Aviation, which appeared during the month of September.

The Airship is here : by Frederick Todd. The World's Work, Sept. 1908.

First rate article. Pictures exceedingly good.

The Real Navigation of the Air : By George H. Guy. Review of Reviews, Sept. 1908.

An article which covers pretty well the work being done in foreign countries. It also speaks of the Zeppelin Dirigible.

The Wright Brothers Aeroplane : by Orville and Wilbur Wright. Century Magazine, Sept. 1908.

This article is one of a very few we have had from the Wright Brothers. It traces their experiments from the beginning. Though it is not a detailed account, it is, nevertheless interesting.

& T he Aeroplane and Its Future : By Henri Farman. The Metropolitan Magazine, Oct. 1908.

This article contains principally a biography of his own machine.

23

GENERAL REMARKS .

There seems to be more activity in the aerial world abroad than there is in this country at the present time. This is only natural under the present circumstances, however.

At Le Mans, France, there seems to have been some rivalry between Wilbur Wright and Henri Farman. On October 1, Farman succeeded in covering a distance of 36 kilometers. It is stated that had he not met with some slight accident, causing him to land, he might have succeeded in giving Wilbur Wright a close race. At present Wilbur Wright's record in 48 kilometers — the farthest distance yet covered by a heavier-than-air machine.

It seems that the Russian Government is making contracts for a heavier-than-air machine for naval use, whose principal feature must be in flying slowly; for they claim that unless a machine can accomplish this it would not be practicable for naval warfare.

It is understood that Mr. A.M. Herring of New York is to deliver a machine to the Government before Oct. 14. Mr. Herring has never tried out his machine, and indeed, little is known concerning it, for all of his work has been done in secret. Mr. Herring does not consider Fort Meyer a suitable place for carrying on his experiments, and has asked that an officer be detailed to go with him elsewhere.

The Nations of the world are beginning to realize the tremendous part which aerial machines are to play in the future of their armies and navies, and they will use every possible means to be first in the art of aerial navigation.

G.H.B.

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(Washington Meeting of the Association Sept. 26, 1908: Address of Chairman; Discussion and business transacted).

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ADDRESS OF THE CHAIRMAN AT THE WASHINGTON MEETING, SEPTEMBER 26, 1908.

(Revised from the stenographers notes).

The special object of this meeting is to consider the future of the Association as affected by the death of Lieut. Selfridge, and to give Mr. Edward A. Selfridge an idea of what interest his son had in the Association.

There may be property rights involved, and Mr. E. A. Selfridge as the legal representative of the heirs of Lieut. Selfridge should be fully informed upon the matter. It is true that at present we can attach no pecuniary importance to our work, but who can speak for the future? It may be possible that some day or other our work may be found to be of value after all, in which case the heirs of Lieut. Selfridge will be entitled to his share of the proceeds.

There may be nothing in it, and I cannot say that I am particularly optimistic in the matter. At the same time there may be “millions in it” as the younger members hope. At the present moment we haven't anything, and until a search has been made we do not even know that we have any inventions that we may justly claim to be our own. A great deal of work has been done in relation to flying machines, and there are many patents to be examined before we can be certain that we have done anything entitled to the protection of a patent; and of course the pecuniary value of our work will depend upon the patentable inventions produced. 2 2 While it is not a good plan to be too optimistic, optimism is surely preferable to pessimism. It can do no harm, and it may ultimately prove to be a wise course, to proceed in this matter, as though we were sure of all the financial returns we could desire.

It therefore seems to me proper upon this occasion to give Mr. E. A. Selfridge some account of the past history of the Association, and what the rights of his son are in the matter. It is more especially necessary to do this, because, by our original article of organization, the Association comes to an end on the 30th day of September, 1908, that is in a few days, unless other plans are unanimously approved by the members.

Now the death of Lieut. Selfridge renders it impossible to obtain unanimous action on the part of all the interests involved, without the aid of Mr. E.A. Selfridge, as the representative of the interests of our deceased member.

It seems therefore wise that we should take advantage of the presence of Mr. Selfridge in Washington to have a special meeting of the Association to consult with him, and obtain his vote in place of that of his son, Thomas E. Selfridge, on matters requiring unanimous approval by all the interests concerned.

Now in regard to the origin of the Association. You know that as the results of my experiments with large tetrahedral structures, I was very anxious to carry on the work to the point of trying the experiment of propelling one of these structures by its own motive power to carry a man, and make 3 3 an aerodrome of it, and when I came to look over the matter I found I did not have sufficient knowledge to risk sending a man up, as I was not sure of the engineering points involved. So I associated with myself two engineers, Mr. McCurdy and Mr. Baldwin, so that I might have the advantage of their technical knowledge of engineering. Then when we came together we still found that we did not have among the whole of us the knowledge necessary to make an aerodrome. We did not have an expert knowledge of motors, and so I sought the assistance of Mr. Curtiss, probably the greatest motor expert in the country.

Sometime before this a young man called upon me in Washington, an officer of the U S Army, who turned out to be Lieut. Thomas E. Selfridge. He showed a great deal of interest in the whole subject of aerial locomotion, and expressed a desire to witness our experiments with tetrahedral structures in Nova Scotia. I found that he had devoted a great deal of attention to the subject of Aeronautics, and in fact had made a special study of Aviation, and what was being done in relation to heavier-than-air machines in all parts of the world with the idea that sometime or other the U S Government would require flying machines in the army and that, when that time came, the services of the officer who had made an expert study of the subject would be in demand, and he would be sure of promotion into a field of usefulness where he could be of great benefit to his country. I was very much pleased with the patriotic spirit of Lieut. Selfridge, and at his suggestion I wrote a note to the President of the United States, backing up his 4 4 application to be detailed to Nova Scotia. His application was favorably considered, and he was detailed by the War Department to observe my experiments in the interests of the U S Army. Lieut. Selfridge repaired to Baddeck. Mrs. Bell and I gave him a cordial welcome to Beinn Bhreagh, and he became our guest there. Thus it happened that la t s t year (1907) I had succeeded in gathering together a remarkable group of young men, all interested in Aviation, and all experts in various lines:- Mr. Baldwin, Mr. McCurdy, Mr. Curtiss and Lieut. Selfridge. The first three acting as my assistants and the fourth as expert observer for the U S Army. They were all my guests in my own home. Residing together under one roof we became quite intimate. We breathed an atmosphere of aviation from morning till night, and almost from night to morning. Each felt the stimulus of discussion with the others, and each developed ideas of his own upon the subject of Aviation, which were discussed by all. I may say for myself that this Association with talented young men proved to be one of the happiest periods of my life. Both Mrs. Bell and I became much attached to them all. Indeed we came to look upon them as members of our family rather than as strangers gathered together from the four quarters of the world. Mrs. Bell especially was very much struck by the possibilities involved in the association of an elderly man like myself with young men of brilliant ability and experts. Why, said she, should we separate, could some plan not be devised for making our association with one another permanent. Her idea was that in the distant future after I should 5 5 have passed away that my influence might remain with these young men and that I should bequeath to them the work in which I was so much interested. So she suggested that instead of these young men remaining as my assistants merely, we should come together in an association on equal terms that would develop their individualities.

Of course it was necessary to supply some means by which experiments could be carried on upon the association basis, and Mrs. Bell suggested a plan that would afford the necessary financial support.

Nearly all the property possessed by Mrs. Bell came from me, but she took great pleasure in pointing out the fact that she had a piece of property with which I was in no ways concerned. This was a lot of land in Washington, D.C., which had been given to her by her father many years ago. It was not of much value at the time of the gift, as it was outside of the City and simply an empty house lot in the suburb. The growth of Washington has since brought buildings all about it. It has gradually increased in value and is now one of the few remaining unoccupied corner lots. It has never brought her in any income and has only been a source of expense on account of taxes. Were she to give it away to the proposed Association, she said, it would not deprive her of any income, and the sale of it might provide funds to start the Association on a career of usefulness. She would be proud, she said, to give something of her very own for this purpose.

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6 This was the origin of the Aerial Experiment Association. We could not live upon an empty lot of land and it is difficult at a moments notice to find a suitable purchaser for property of this kind. So Mrs. Bell decided that instead of giving the land she should donate to the Association its estimated value and hold the land in her own name until it could be suitably disposed of.

A long time ago the land was estimated to be worth about $20,000.00, but since then it has increased in value, and is now worth much more, perhaps even twice as much.

We could not estimate what our annual expenses would be and I was unwilling that Mrs. Bell should be called upon to supply more funds than would be absolutely necessary for our experiments, and so it was finally arranged that Mrs. Bell should supply funds to the Association as needed to a limit of $20,000.00, her total contribution not to exceed this amount. We thought, however, that this would be sufficient to support the Association for at least one year.

The Association was organized in Halifax, Nova Scotia, on the 1st of October, 1907, to last for one year only unless other arrangements were unanimously agreed upon by the members before the expiration of that term. Thus the Association will expire by time limitation on the 30th of Sept. 1908, only four days from to-day, unless we can have the assistance of Mr. E.A. Selfridge as the representative of the late Thomas E. Selfridge to continue it for another period of time. Our estimate of expenses has turned out to be remarkably correct, and by the 30th of Sept. we shall probably have consumed 7 7 the whole of the appropriation provided for.

I am now authorized by Mrs. Bell to state that if the members desire to continue the Association for another six months she will be glad to provide the funds so long as she is not called upon for a larger sum than $10,000.00 making her total appropriation for the benefit of the Association not to exceed $30,000.00 in all.

Now there is one peculiar feature about this Association that I think is worthy of notice. None of us have been swayed from pecuniary motives. Our object, as expressed in the words of Lieut. Selfridge, and incorporated into our agreement of organization was sim ? p ly “to get into the air”, and Mrs. Bell has donated the funds for the support of the Association not from any expectation of return, but simply from affection for us all and from interest in our work.

When we first came together as an Association, we recognized the possibility that joint-inventions might be produced which might have pecuniary value; and we agreed that before dividing the proceeds, if any, equally among the members, as provided for in our article of agreement, that we should remember Mrs. Bell's financial contributions and present to her a 1% interest for every one thousand dollars she should contribute for the support of the Association. This means that if we ever receive anything for all our work we will first present to Mrs. Bell as a recognition of her services 1% of the proceeds for every thousand dollars she has contributed and divide the remainder equally among ourselves. 8 8 Of course if we don't receive anything we will have nothing to distribute, and we will be finally in the position in which we were originally and in which we stand to-day.

For the information of Mr. Selfridge, I may say, that if we ever do get anything the heirs of the late Thomas E. Selfridge will be entitled to # of the proceeds remaining, after handing over to Mrs. Bell the percentage agreed upon. If we dissolve on the 30th of Sept. we would have first to assign about 20% of our prospective interest to Mrs. Bell on the assumption that she has contributed $20,000.00, which I think is about the sum, and this would leave 80% to be distributed equally among the original members, and # of this or 16% would belong t b o the heirs of Thomas E. Selfridge.

Should we continue the Association for another six months as proposed, more money would be required, and this would reduce the percentage to be divided among the members, so that the proportion to go to the heirs of Thomas Selfridge would be reduced to less than 16%.

It is obvious, therefore, that it would not be proper for us to continue the Association beyond its alloted time without the full consent and approval of Mr. Edward A. Selfridge as the representative of the interest of the late Thomas E. Selfridge. This is why I have thought it important to invite him here to-day to confer with us upon the future of the Association as affected by the death of Lieut. Selfridge.

When the Association was first organized it came into existence primarily to help me with my tetrahedral structures, and then to work conjointly at each others ideas so that each 9 9 man should have an opportunity to show what there was in him, and have aerodromes built by joint efforts upon plans approved individually by each of us in turn.

Beginning in Oct. 1907, the Association worked at my tetrahedral structures until the middle of December, 1907, when the kite “Cygnet” was completed in which Lieut. Selfridge made an ascent. The kite flew very steadily in the air at an elevation of about 168 ft. and came down so slowly and gently that Lieut. Selfridge whose view of the water was cut off by the silk surfaces below him, was quite unaware that the kite was coming down until he reached the water. Not being prepared for the descent he failed to release the towing line so that the kite was wrecked by being dragged full speed through the water by the steamer Blue Hill. It is needless to say to this audience that this accident did not in any way reflect upon the flying qualities of the kite. Its behavior in the air was eminently satisfactory, and it was not designed to stand the strain of being pulled through the water.

Shortly after the death of Lieut. Selfridge a statement appeared in a Boston newspaper, purporting to eminate from a cousin of Lieut. Selfridge to the effect that his fall in the Wright Brothers machine was not the first disaster of the kind that had happened to him. The impression left by the article was that the tetrahedral kite “Cygnet” had made a sudden dive similar to the drive of Orville Wright's machine and that Lieut. Selfridge's life had only been saved by the fact that he fell upon water instead of on land. This, however, is a mistake made by one who had not witnessed the flight. 10 10 He had no “fall”, he simply came down gradually. The descent was so gentle that he knew nothing of the descent until he reached the water. The subsequent destruction of the “Cygnet” was not by any means due to anything that happened in the air, but was purely due to the structure being towed at full speed through rough water; of course, not being designed for that, the structure broke in pieces.

The destruction of the “Cygnet” in December, 1907, interrupted the experiments with tetrahedral structures for, of course, it takes a long time to put together the materials for such a machine. It became necessary, therefore, to postpone further work at Beinn Bhreagh until the opening of ? n avigation in the Spring of 1908. It was therefore decided that while materials for a new tetrahedral structure were being made at Beinn Bhreagh the Association should make its headquarters at Hammondsport, New York, for the winter, and that the younger members of the Association should there have the opportunity of carrying out their own ideas individually in turn assisted by me, and by the other members until the time should come to return to Beinn Bhreagh and resume the tetrahedral experiments.

As Lieut. Selfridge had risked his life in my machine I felt that he had earned the right to be the first to have experiments made upon his own plans, and so it was decided that the Association should give its aid to him.

The plan inaugurated by him at Hammondsport was to repeat the experiments of others. To start out by constructing a gliding machine and gain practice in gliding without a motor as a preparation for dynamic flight with an engine and propeller 11 11 as had been done by all, or nearly all of the successful aviators of the world. While experience was to be gained in gliding flight the members of the Association were to study the successful motor-driven machines that had been produced elsewhere including what little was known or surmised of the machine of the Wright Brothers, who were then working in secret and allowed very little information to leak out.

In a word the policy suggested by Lieut. Selfridge was to walk in the footprints of those who had gone before and then advance beyond.

In pursuance of th ? i s policy gliding machines were made at Hammondsport, and all the members with the exception of myself made many experiments at gliding flight.

Then the Association advanced to the power-driven stage, and constructed an aerodrome upon plans approved by Lieut. Selfridge. As my tetrahedral structures had only reached the man-carrying kite stage and had not been fitted with a motor and propeller, this aerodrome became our No. 1, known as “Selfridge's Red Wing”.

Mr. Selfridge :— I did not know that Tom took credit for that altogether, but thought that these other men were associated with him.

Dr. Bell :— He did not. There was joint work upon the machine, all the members present in Hammondsport being associated with him, but the plans of the “Red Wing” were to be approved by him and the machine was to bear his name. As a matter of fact our chief engineer, Mr. Baldwin, had more to do with it in the matter of details than Lieut. Selfridge, but 12 12 everything done was approved by him.

Selfridge's “Red Wing” made a successful flight of three hundred and nineteen feet over the ice on Lake Keuka, near Hammondsport, New York, on March 12, 1908, in the presence of many witnesses. This experiment was somewhat remarkable as being the first successful public flight of a flying-machine in America, the earlier flights of the Wright Brothers at Dayton, Ohio, having been made in secret. The machine had been provided with sledge runners, and glided over the ice for about one hundred to one hundred and fifty feet before it rose into the air. It then flew very steadily at a general elevation of from ten to twenty feet above the surface of the ice carrying Mr. F. W. Baldwin as aviator.

Aerodrome No. 1, “Selfridge's Red Wing” came to an untimely end on March 17, 1908, by an accident which completely demolished the machine, although fortunately the aviator and the engine escaped uninjured.

The Association then immediately began the construction of aerodrome No. 2, Baldwin's White Wing”, upon plans approved by Mr. Baldwin. After several successful flights this machine also came to grief, and the Association then proceeded to construct aerodrome No.3, Curtiss' “June Bug”, in accordance with plans approved by Mr. Curtiss.

Mr. Selfridge :— Mr. Curtiss did not ascend successfully with the “June Bug” did he?

Dr. Bell :—Oh! yes, and he probably had a good deal more to do personally with the “June Bug” than perhaps Lieut. 13 13 Selfridge had with the details of his own machine, the “Red Wing”. In all cases, however, there was discussion over details by the members and conjoint action.

Mr. Selfridge :— Tom told me that he wished me to understand that these young men that were associated with him were acting conjointly with him, and that he could not say that anything was his own.

Dr. Bell :— The idea of the Association was conjoint action. I was in Washington a great portion of the time and only spent a short period in Hammondsport, so that the assistance which I was able to render was chiefly through correspondence. The other members of the Association resided in Hammondsport under the same roof and were in constant communicattion with one another, and all took part in the development of all the machines through discussion and suggestions. As a matter of fact it is probable that the chief part of the designing of all these aerodromes was done by the chief engineer Mr. Baldwin, although I believe that Mr. Curtiss had a great deal to do with the special features of the

“June Bug”, if, indeed they were not exclusively of his own design. In all cases the plans were put into execution by Mr. Curtiss, who acted officially as “Director of Experiments”.

Aerodrome No. 3, Curtiss' “June Bug” turned out to be a very successful machine, and numerous flights have been made with it, and it is still in existence available for further experiments. All the members with the exception of myself have tried it, and on the 4th of July 1908, Mr. Curtiss, in the 14 14 “June Bug” flew in public under the official observation of a committee of the Aero Club of America, a distance of one kilometer measured in a straight line, thus winning the Scientific American Trophy for heavier-than-air flying-machines. As a matter of fact he went much further than one kilometer exceeding, if I remember rightly, a mile.

When we left Beinn Bhreagh in December, 1907, it was not expected that we would be able to build at Hammondsport more than one, or at most two aerodromes; for we intended to return to Nova Scotia in the Spring as soon as navigation opened and continue our interrupted experiments with tetrahedral structures over open water.

It so happened, however, that Mrs. Bell had become seriously ill in Washington and when the usual time arrived for going to Beinn Bhreagh Mrs. Bell was in no condition to be removed and I, of course, could not proceed without her. It seemed therefore advisable for the other members of the Association to pursue still further the line of investigation with which they had started at Hammondsport, while I remained in Washington giving such assistance to them as I could by correspondence. I was also able to make a short visit to Hammondsport when the June Bug was ready for trial.

On the 4th of July, when Curtiss won the Scientific American Trophy, I was traveling with Mrs. Bell by easy stages to Beinn Bhreagh and had reached Prince Edward Island, when the news reached me by telegraph that we had won the Trophy. 15 15 It had been the intention of the Association to adjourn to Beinn Bhreagh immediately after the 4th of July, but when I came to consider the fact that it would take a long time to assemble the materials for the proposed tetrahedral aerodrome and that the Hammondsport experiments had attracted the attention of the world, it seemed to me a pity to stop the Hammondsport line of investigation until the tetrahedral structures at Beinn Bhreagh were ready to be flown. It also occurred to me that all the younger members of the Association, with the exception of Mr. McCurdy had had aerodromes constructed upon plans approved by them, and that if Mr. McCurdy desired in his machine, to adopt the Hammondsport type, it might be well to give him the opportunity of having his aerodrome built at Hammondsport while we were getting ready for experiments at Beinn Bhreagh.

The Hammondsport experiments had been broken by the destruction of the “Red Wing”, and some time had necessarily to elapse before they could be resumed with the “White Wing”. The same thing happened upon the destruction of the “White Wing”. A long delay elapsed before the “June Bug” was ready for trial. After winning the Scientific American Trophy, it seemed wise to construct another aerodrome upon the same general plan without waiting for the destruction of the “June Bug”. By having two aerodromes at our disposal the experiments of the Association would not be interrupted should one be destroyed.

I therefore suggested that if Mr. McCurdy desired to pursue the Hammondsport line of investigation, it would be well 16 16 to divide the Association, and carry on work at Hammondsport and Beinn Bhreagh simultaneously, Messrs. Curtiss and Selfridge to remain in Hammondsport with Mr. McCurdy so as to give him there assistance in constructing his aerodrome, and Mr. Baldwin to proceed to Beinn Bhreagh to give me his assistance with my tetrahedral structures. The two sections of the Association to be kept in touch with one another by the issuance of weekly Bulletins by the Chairman. This plan was adopted and the first Bulletin was issued July 13, 1908.

Lieut. Selfridge, however, did not remain very long at Hammondsport as he was ordered to Washington by the War Department. He was transferred to the Signal Corps of the Army and, on account of his expert knowledge of aviation he was made a member of the

Aeronautical board of the Army. Thus the members of the Association became scattered. Selfridge was in Washington attending to his military duties; Curtiss and McCurdy were in Hammondsport engaged in the construction of McCurdy's aerodrome, and Baldwin and I were at Beinn Bhreagh working upon tetrahedral structures. But though scattered we were kept in touch with one another through the Bulletins of the A.E.A. and were able to exchange ideas and carry on cooperative work even better than before. Before July 13, 1908, our most important discussions were by word of mouth and left no record behind. Since the establishment of the Bulletins communications between the scattered members have appeared in written form, so that the records of our work, although very imperfect, are more complete than before.

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17 Our aerodrome No. 4, McCurdy's “Silver-Dart” is now completed and ready for trial.

Mr. McCurdy :— It is all finished except the motor.

Dr. Bell :— After Mr. McCurdy has had sufficient time to test out this machine, Mr. Curtiss and Mr. McCurdy will proceed to Nova Scotia where all the surviving members will come together at Beinn Bhreagh to assist me with my tetrahedral structures.

At Beinn Bhreagh we have two new aerodromes employing tetrahedral structures in process of construction. The first which is expected to be our aerodrome No. 5 is of pure tetrahedral construction, in which oblique surfaces alone are employed. It is practically the “Cygnet” over again with improvements and the latest form of motor developed by Mr. Curtiss will be used in the attempt to propel it through the air. The great advantage of the pure tetrahedral form of construction in large machines employing multitudes of small winged cells is the automatic stability displayed by such structures. The chief disadvantage is the poor lifting power of oblique surfaces when compared with the lifting power of the same surfaces horizontally arranged. From which it results that a structure intended to support a man and an engine in the air must be made of very large size in order to afford sufficient supporting surface. The large size of such a structure and the great head resistance offered by the multitude of cells composing it render it exceedingly problematical whether the motors at our disposal will be able to drive it at a supporting velocity. The only way, however, to solve the problem is to make the experiment and this 18 18 we shall do in our aerodrome No. 5.

I have long been anxious to try as an aerodrome another form of tetrahedral structure employing both oblique and horizontal surfaces.

Mr. Selfridge :— That suggested itself to you as the results of the first experiment?

Dr. Bell :— Yes, to remedy the deficient lifting power.

The kites that have been constructed upon this plan, known as Oionos Kites, have exhibited great lifting power, but they have not the stability in the air possessed by kites of pure tetrahedral construction. I did not wish therefore, to try an aerodrome upon this plan until the experiments with aerodromes of pure tetrahedral construction had been completed. A structure of this kind will form the basis for our aerodrome No. 6 and it is proposed that instead of flying the structure as a kite, its body shall be in the form of a boat with outriggers so that it can float upon the water and rise from the water after the manner of a water bird. This aerodrome has been placed especially in the hands of Mr. Baldwin for development. He proposes to place hydroplanes under the boat-body to assist it in rising, and he is now engaged in experiments with the boat-part of the structure. He has produced a very promising boat which makes 15 miles an hour when driven by an aerial propeller operated by a 15–20 horse power engine without any hydroplanes or aeroplanes to assist it. This boat is known as the Dhonnas Beag.

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19 The aerodrome of which such a boat will form the body, will start from the water; and if it develops speed enough under its own motive power to rise from the water into the air, it will become a true flying-machine, and need not rise to any great elevation above

the water. This seems to be the safest way of getting into the air. Although the structure will not possess the automatic stability of the pure tetrahedral construction, it will be no more unstable than the Hammondsport aerodromes, or the machines used by the Wright Brothers, and the foreign experimenters. As it is expected to fly at an elevation of only a few feet above the surface of the water, the danger in case of accident would not be great, for it would drop into the water instead of on land.

I would not hesitate to make a flight myself in such a machine, whereas I would hesitate to try one of the Hammondsport aerodromes. I leave such exploits to the younger members of the Association. They like the risk, I do not. With young men an element of danger adds zest to enjoyment. Older men prefer to eliminate the dangerous features altogether. Should our aerodrome No. 6 succeed in rising from the water under its own motive power it will undoubtedly become an epoch making machine.

This is the limit of our plans for the present, but we have not yet been able to advance them much beyond the theoretical stage. On account of Mrs. Bell's illness the season was far advanced before we could commence work upon our tetrahedral 20 20 aerodromes at Beinn Bhreagh, and for this reason the structures will not be in condition to be tried before the day arrives for the Association to come to an end unless some unanimous action can be taken to continue it for another period of time.

A meeting had been called for the 30th of September the last day of grace, when it was expected that all the members would be present at Beinn Bhreagh, but alas, we now know that we can never all meet again. The accident to Orville Wright's machine has deprived us of our fellow member Lieut. Selfridge, and we cannot even reach a unanimous decision without the assistance of Mr. E.A. Selfridge, the legal representative of his heirs.

(The Association then proceeded to business. The resolutions that were passed at the meeting appeared in Bulletin XIII, pp. 5–7. The stenographers notes enable us to preserve some of the subsequent proceedings).

Dr. Bell :— Have you brought a copy of the original agreement of organization from Hammondsport, Mr. Curtiss?

Mr. Curtiss :— Yes sir, and it is here.

(Dr. Bell then read the agreement of organization signed in Halifax, N.S., Sept. 30, 1907, a copy of which may be found in Bulletin X pages 22–25).

Dr. Bell :— For Mr. Selfridge's information I will say that we have been carrying on our experiments purely in the interests of aviation without any pecuniary motives whatever.

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21 Mr. Selfridge :— Eliminating the commercial aspect?

Dr. Bell: — Eliminating the commercial aspect.

Mrs. Bell also has supplied us with about $20,000.00 to support our experiments, without any conditions looking to return or gain. We all of us believed, however, that in carrying on experiments of this sort, we would be liable to come upon new ideas, and we decided that should we produce any investigations of a patentable nature it would be a matter of wisdom to have them patented. The difficulty was to know how to do it. Mrs. Bell's financial contributions could not be used for the purpose, having been specifically given to cover experimental work alone. We cannot expend her money upon patents, or in litigation, but only to cover the actual cost of our experiments.

I held the ground that patents belonged to the commercial stage of an invention not the experimental; and should be paid for by a company or by individuals interested in commercial developments, not by one like Mrs. Bell who cared nothing for such matters, and was only interested in promoting the experimental work of the Association.

I recognized however, that patentable inventions made by the Association could hardly be transferred or sold to a Company unless already patented; and so I have personally assumed the expense of applying for patents on the Hammondsport work with the expectation of being re-couped for my expenditures by any company that might take up the Hammondsport 22 22 aerodromes in a commercial way.

Mr. Selfridge :— Then you have already applied for patents?

Dr. Bell :— No, not yet. I have ordered a preliminary examination of patent records to be made in our interest, and a specification to be prepared should it turn out to be the case, that our inventions are not already covered by existing patents. So many people have been working at flying-machines, that it will be very difficult to steer clear of existing patents and get a patent of any value to represent our work.

Mr. Selfridge :— You may be trespassing on some other persons property.

Dr. Bell :— Exactly. We do not know what other people have done, and I am unwilling to apply for a patent until I have some assurance from my solicitors that we really have something that we can rightfully claim as our own.

An examination is now being made to see whether we have got anything to patent. If we have, then a patent will be applied for. Then as a patent may have commercial value we should appoint a Trustee to hold these patents and dispose of them to the best interests of the Association. This Trustee would distribute the proceeds if any in accordance with our agreement of organization, and of resolutions of the Association. Of course it may be possible that we are making a mountain out of a mole-hill, but I cannot forget the early days of the telephone when business people said there was nothing in it. There may be nothing in this, but we are not going to take any chances 23 23 about it. We will proceed as though it were the most valuable thing in the world and make due preparations.

Mr. Selfridge : Do I understand that Mrs. Bell's wishes made her contribution of $20, 000.00 for the benefit of science, but that out of anything realized from the sales Mrs. Bell is to receive 20%.

Dr. Bell :— That was the action of the Association not of herself.

Mr. Selfridge :— Of course Mrs. Bell is entitled to it absolutely, and it is nothing more than an acknowledgment of her good will in recognizing the Association by contributing toward it.

Dr. Bell: — Yes sir.

Mr. Selfridge :— But Mrs. Bell did not expect any remuneration in return.

Dr. Bell :— No. She said she had a piece of property that she never gained anything from that she would sell to provide funds for the Association. She had no thought of remuneration but gave her contributions as a pure gift to the Association; it was “throwing her bread upon the waters” as it were in the interest of the cause.

In our original article of agreement which is before me here we have this clause:—

“This agreement can only be modified by unanimous vote of the undersigned”.

Lieut. Selfridge was one of the signers so that strictly and literally we cannot continue our Association beyond 24 24 the 30th of September or make any change whatever in our agreement without the consent of Lieut. Selfridge. The death of Lieut. Selfridge has tied our hands in this matter and the special object of this meeting is to get over this difficulty so that we shall be able to continue the Association for another period of time, say six months, and be free to do something.

Our plan of procedure, I think, should be to recognize Mr. E.A. Selfridge as the legal representative of his son and permit him to cast the vote for Lieut. Selfridge. That is the main business we have to do to-day.

I have received a letter from Mrs. Bell in which she speaks of Tom. It is really quite a touching letter and I will read an extract from it, which will give Mr. Selfridge an idea of how she felt towards his son.

(Dr. Bell then read an extract from this letter which is given in Bulletin XIII pp. 27–28. “On the death of Selfridge by Mrs. Bell”).

Mr. Selfridge :— Beautiful, beautiful expression.

Dr. Bell :— I think it is a beautiful letter, and I will ask our new Secretary, Mr. McCurdy to make a copy of this extract and send it to Mrs. Selfridge. It shows the spirit of Mrs. Bell in the whole matter and her attitude towards the members of the Association, and her desire that the Association shall continue its organization just as it is without change.

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25 (The various resolutions given in Bulletin XIII, pp. 5–7 were then adopted and it was suggested that it might be well to add a provis?, that the Association could be continued beyond the 31st of March 1909, by unanimous consent. It was decided, however, that formal action on this point was not necessary.)

Mr. Selfridge :— All it requires is unanimous consent to continue it from period to period as you think proper. It is, simply a rep i e tition of your original motion or article, is it not? That nothing must be done except by unanimous consent.

Dr. Bell: — No, not “Nothing” but only certain points. While a majority vote would be sufficient upon most matters, the fundamental agreement was not to be modified excepting by unanimous consent.

(Mr. Selfridge suggested a resolution to the effect that Mrs. Bell should be given a 1 per cent interest for every thousand dollars contributed over the amount she had already given, but this was considered to be unnecessary in view of the past action of the Association, providing for this interest without any specification of limit. Mrs. Bell had herself limited her contributions to $20,000.00. Now she extends the limit to $30,000.00. That is all and no action by the Association was considered necessary).

Dr. Bell :— I would like to bring to your attention the question of the appointment of a Trustee for the Association 26 26 I have employed Messrs. Mauro, Cameron, Lewis and Massie to make an examination of patents to see whether we have anything that we can patent. I am advancing the costs personally from my own pocket and not from the funds of the Association. If we find that we have anything that is patentable we will have that patent taken out, and the expenses will be charged, not to the Association, but to any Company, or commercial organization that will take up the patent. As we have Mr. Selfridge with us to-day it would be advisable for us to appoint a Trustee for the Association to whom patents might be assigned and who would hold the patents in his own name as Trustee until they could be transferred to a commercial organization. The question of the appointment of a Trustees is now in order.

Mr. Curtiss :— I move that Mr. Bell be made the Trustee.

Dr. Bell :— No, I am not a business man. Perhaps, however, you refer to Mr. Charles J. Bell, President of the American Security and Trust Company. He would be an admirable man for the purpose. I had the opportunity of talking with him the other day, and I asked him what his attitude would be in the case we requested him to act as Trustee.

He said he would be glad to act as Trustee if desired, but that he could not undertake to organize a Company or to put our inventions into commercial use. All he could agree to do would be to hold the property as Trustee for the Association, and see that it was disposed of in accordance with the 27 27 agreement of organization and resolutions of the Association. Since then, in talking over the matter with Mr. Cameron, he suggested the idea that it might be a good plan to make a Trust Company Trustee rather than an individual. For the individual may die whereas the Trust Company will not. He suggested the American Security and Trust Comapny rather than Mr. Charles J. Bell, its President, individually.

We should remember, however, that in this whole matter we are simply making a provision for the future taking advantage of the presence of Mr. Selfridge to secure unanimous action, and that at the present time we have nothing to place in the hands of a Trustee. We could not possibly go through the formality of asking a Trust Company to accept nothing in trust , whereas, we can make an arrangement with an individual like Mr. Charles J. Bell to become Trustee for us, when we have something to give him.

Mr. Curtiss :—I know of no better plan than to secure Mr. Charles J. Bell to act as Trustee if we can.

Dr. Bell: I think it would be a good plan to appoint him as Trustee. He could transfer the trust to his Trust Co. if we get anything of value, if desired by the Association. That could be done without any difficulty.

Mr. McCurdy :— Could it be assigned to the Trust Co. They to act through him?

Dr. Bell :— Yes, but the time has not yet come when we could go to the Trust Company for we do not yet possess anything 28 28 tangible of value to be placed in their hands.

Mr. Baldwin :— Shall we take up the matter of the appointment of a Trustee? It is true that we have not anything to hand him, but Mr. Selfridge is here, and it is evidently a matter that requires his consent.

Dr. Bell :— It is well to provide for it.

Mr. Selfridge :— Of course any action of that kind would receive my endorsement whether I was present or not. Why not allow that power to rest with the Chairman in the event that necessity exists to appoint a Trustee to handle the resources for the benefit of the Association. Why not leave it to the presiding officer, Dr. Alexander Graham Bell, to appoint a Trustee.

(Dr. Bell stated, that it was an important matter and that he could not undertake to appoint a Trustee without the formal consent of Mr. Selfridge, and of the surviving members of the Association. Mr. Charles J. Bell was then by resolution appointed Trustee of the Aerial Experiment Association, (see Bulletin XIV, p.7)

Dr. Bell :— Is there anything else that requires unanimous action? Matters that can be settled by a majority vote can be handled at other meetings of the Association, but anything requiring unanimous action had better be brought up now, for Mr. Selfridge resides in California, and we do not know when it may be convenient for us all to come together again.

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29. (Nothing further requiring unanimous action was brought up at the meeting).

Dr. Bell :— There is another matter I would like to bring up although it does not require any formal action at all. The Association will last for at least six months longer and we should be very glad if Mr. Selfridge would allow us to have possession, during that time, of the books, pamphlets and other material relating to aerial Locomotion that Lieut. Selfridge had in his possession.

Mr. Selfridge :—I do not see why you should not have them.

Dr. Bell :—Our new Secretary, Mr. McCurdy could perhaps go with you to the rooms of Lieut. Selfridge and get anything that is of value to the Association.

Mr. Selfridge :—He could make a list of them and give me a receipt.

Dr. Bell:— Some of these things, probably belong to the Association. Mr. McCurdy would be able to tell whether, for example, the aeronautical magazines he received as our Secretary were subscribed for by the Association, or by Lieut. Selfridge personally.

There is one other thing Mr. Selfridge which occurs to me just now. Lieut. Selfridge wrote for the use of the Association a very remarkable paper on the Progress of Aviation.

Mr. McCurdy :—Could I propose that we might ask Mr. Chanute to look it over?

(Mr. E. A. Selfridge gave his consent to the publication by the Association of an article written by Lieut. Thomas E. Selfridge entitled “A Brief Sketch of the Progress 30 30 of Aviation” which formed the subject of our Bulletin No.II, provided that it could be looked over by an expert to see that the statements contained in it were correct. He would not like his son's name to be appended to a paper that contained erroneous statements. He could not judge of the matter himself, but would trust the judgment of an expert like Mr. Chanute. Mr. Chanute offered to revise the paper as to data and references, but not as to the sense of the article).

Dr. Bell :—There is one other matter Mr. Selfridge. I am anxious that Mr. Chanute should have the opportunity of looking over the Bulletins of the Association. There are only seven copies and we have not any here. Lieut. Selfridge's copy, however, is at his rooms. If it would be convenient for you to lend these Bulletins to Mr. Chanute he could return them to you.

(A resolution was then proposed by Mr. Curtiss, seconded by Mr. Baldwin that the official headquarters of the Association be moved to Nova Scotia on the first of October, 1908. The resolution was adopted and the meeting then adjourned)

BULLETINS OF THE Aerial Experiment Association

Bulletin No. XVI Issued MONDAY,OCT. 26, 1908

ASSOCIATION'S COPY.

BEINN BHREAGH, NEAR BADDECK, NOVA SCOTIA

BULLETIN STAFF .

Alexander Graham Bell Editor.

Gardiner H. Bell Asst.Editor.

Charles R. Cox Typewriter.

Mabel B. McCurdy Stenographer.

Bulletins of the Aerial Experiment Association .

BULLETIN NO.XVI ISSUED MONDAY OC t T . 26, 1908

Beinn Bhreagh, Near Baddeck, Nova Scotia .

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ILLUSTRATIONS.

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HYDROPLANES .

Beinn Bhreagh, Oct. 12 1908 :— We have all been disappointed with the action of Baldwin's hydroplanes and at the difficulty of knowing exactly what they do. At the speed of the Dhonnas Beag the hydroplanes have not given us very marked lifting effects. This, perhaps, is hardly to be wondered at when we consider that the load to be lifted is about 400 lbs. including boat and man and engine.

Why might it not be a good plan to tow the arrangement which would allow us to reduce the load to be lifted to a mere float sufficient to prevent the metallic hydroplanes from sinking. They would probably lift a light float without engine or man at a less speed than would be possible with a 400 lbs load; and it might be possible that the Gauldrie, “which goes about six miles an hour now”, says Mr. Baldwin, might be able to tow it at a supporting speed. It certainly would be gratifying to see a boat, however light, lifted completely out of water by the hydroplanes. If we could only secure this result to begin with, we would probably be able to get a better idea of what the hydroplanes are doing and by variations in the arrangement grope our way empirically to an arrangement that would support a 400 lb. load.

We have in the Laboratory a number of old floats that would do for the purpose. I measured and weighed one of them the other day. It was 4 meters long and weighed 7 lbs. I also weighed some small floats that would do for outriggers. 2 2 The heaviest weighed 332 grams. Small silk floats would average less than one-half a pound. It would be necessary to provide a stiff frame to which to attach the hydroplanes and a cross bar or transversal truss to support the outrigger floats. But the weight need not exceed a few pounds.

Main float 7 lbs.

Two side floats 1 lb.

Frame for hydroplanes 10 lbs.

Cross bar 5 lbs.

For luck 2 lbs.

Total 25 lbs.

The hydroplanes would probably lift this load when towed by the Gauldrie, much better than they now lift their present 400 lb. load when propelled by an aerial propeller.

Mr. Baldwin found, by means of a spring-balance, that one set of these hydroplanes exerted a lift of about 75 lbs. Perhaps the three sets together may be able to lift a load of 25 lbs. completely out of water at the speed of the Gauldrie. The experiment is certainly worth making. A.G.B.

FRONT CONTROL .

Beinn Bhreagh, Oct. 13, 1908 :— Should not the front control be at the rear instead of in front?

Imagine a long pole balanced on a horizontal axis at its middle, and carrying a horizontal surface at one end. Under the action of wind the surface will be carried to the rear like the vane of a weather-cock. If we hold the pole so that the surface is at the front end facing the wind the 3 3 whole arrangement is in a state of unstable equilibrium requiring an effort to keep it in place. Is not this the case with the front control of an aerodrome, and would it not be better to use a horizontal tail at the rear?

The natural action of the wind of advance upon the front control is to upset the whole machine upwards or downwards so as to make a complete somersault and bring the front control to the rear as a tail. Whereas the natural action upon a horizontal tail at the rear is to keep the longitudinal axis of the machine parallel to the line of advance and prevent any deviation up or down excepting by the will of the operator. A.G.B.

DISCUSSIONS .

An important innovation on our practice was inaugurated October 14, 1908, by having a stenographer present during our discussion of the above note on “Front Control”.

Miss Mabel B. McCurdy, having been appointed stenographer for the Association, was present October 14, and attempted to catch the points of the discussion for preservation. Her report, which was submitted to the speakers for correction, appears elsewhere in the present Bulletin.

It is believed that with Miss McCurdy's assistance we may be able to make such discussions a valuable feature of the Bulletins. A.G.B.

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MOTORS .

Beinn Bhreagh, Oct. 16, 1908 :—The Cygnet was just able to carry a man in the air and could not have carried a motor in addition. In designing aerodrome No.5, it was made large enough to carry a man, and an engine of the weight of a man, but the new motor now being completed in Hammondsport, Baldwin thinks, will weigh about 350 lbs with the various accessories required. That is, it will weigh more than two average men.

This leads me to suspect that we are not advancing in the right direction in the construction of our motors. Why this increased weight? Because we are trying water-cooling instead of air-co l o ling and water is 773 times as heavy as air.

But why do we try water-coo o l ing? Because air-cooling has not succeeded so far in preventing our motors from becoming overheated in a very short time.

Overheating is undoubtedly a defect and we have to add on another instrumentality, air-cooling to remedy it. The employment of a cooling agent 773 times heavier than the former agent employed seems to me also to be a defect. We are correcting one defect by employing another.

Should our attention not be directed to the prevention of overheating rather than to its correction. If overheating is a necessary result of the type of engine we employ would it not be better to change the type?

This brings me to the consideration of the paper I read at the meeting of the Association in May 1908 (see Bulletin No.1, pp 27–29) concerning “Light Motors for Flying Machines”, in which a new type of engine is suggested utilizing 5 2 atmospheric pressure as its motive power. Of course we must use in our present experiments the motors we have with all their e d efects whatever they are, but this should not prevent us from considering the question of type, and from making experiments in a tentative way that would not interrupt the experiments already planned.

The paper referred to shows clearly, I think, that the materials composing the working parts of a motor can be made of thinner and lighter material where the operative power comes from without than when we use the expansive power of a compressed gas.

As the matter stands now in my mind there are three agencies needed in the atmospheric type of engine. (1) A means of rar ? e fying air. (2) A means of storing it, and (3) the operative part of the engine. There can be no question that the operative part of the engine can be made lighter than if we used compression. It is also obvious that the reservoir for containing our store of rar i e fied air can also be made lighter than a similar reservoir designed to stand the bursting pressure of a confined gas. The question then remains;can we employ light means for effecting rar i e faction.

If we have to pump out air out of our reservoir by mechanical means we must employ a pump and an engine of some sort to work the pumping mechanism. This involves weight and must be put out of consideration.

We can effect the same end however, by the mere application of heat and heat has no weight. For example:— If we take a chamber of heated air at atmospheric pressure and then 6 3 seal up the chamber and allow the air to cool, then upon cooling a partial vacuum will be found within the chamber and the rar i e fied air can be used in the operation of the engine.

The question then resolves itself into the single point; can we heat the air in a chamber without employing heavy means. The following experiments made at Beinn Bhreagh Laboratory seem to indicate that we can.

A glass jar 12 inches in height and having a cross section of about 36 square inches was taken. A piece of paper was then lighted and thrown into the jar which was immediately turned upside down in a basin of water. The flame went out and the water rose so as to half fill the jar. This shows that the simple burning of a piece of paper expelled half the air within the jar so that upon cooling an unbalanced pressure was produced, equal to ½ an atmosphere which caused the water to rise in the jar. Suppose the intrusive water to be replaced by a piston moving in the jar as a cylinder we can calculate the pressure exerted upon the piston. A pressure of half an atmosphere is equivalent to 7 ½ lbs upon every square inch of surface. The surface of the piston was equivalent to 36 sq. in so that the pressure exerted would have been 36 × 7 ½ = 270 lbs.

Thus the simple burning of a piece of paper within the jar produced a pressure of 270 lbs.

In another experiment a little dish containing about a teaspoonful of gasoline was floated upon water. The jar was held mouth down over it for a moment so as to get warm and was 7 4 then pushed down into the water leaving the burning gasoline floating inside the jar. The flame speedily went out and water rose within the jar until the jar was 6/10 full of water. The pressure that raised the water was equivalent to about six tenths of an atmosphere or in this case about 324 lbs.

These experiments are suggestive and indicate that very light means can be employed to produce the necessary rarefaction of air to work an atmospheric engine, and that it would pay to devote some attention to the matter. A.G.B.

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FLEXIBLE HYDROPLANES.

Beinn Bhreagh, Oct. 17, 1908 :— This afternoon Baldwin succeeded in lifting the Dhonnas Beag completely out of the water on its hydroplanes, by reducing its weight by the omission of the engine and man and towing it, by the Skidoo. I believe this was done yesterday and this morning, but I did not myself witness these experiments. I saw the experiments this afternoon however, and they were certainly most stri , k ing. There was a clear space of about a foot between the bottom of the boat and the water. I need not describe the experiments here as field notes were taken by the Assistant Editor, Mr. Gardiner Bell and appear elsewhere in the Bulletin. The Skidoo makes a speed of between 7 and 8 miles an hour so it is evidently not necessary to employ high speeds to study the effects of hydroplanes. If very light floats were employed I have no doubt the hydroplanes would rise when towed by a row-b a o at! At all events we now have the certainty of being able to study the effects of hydroplanes at low speed and apply the results to heavy loads at high speeds. Try the hay-rake idea. Why not use the rubber floats we have for the support of hydroplanes. Tow them and study the effects of different arrangements of hydroplanes and the effects of loading. A simple arrangement would be a catamaran structure; a simple wooden frame for two of our rubber floats arranged catamaran fashion (see Fig. 1). The teeth of the hay-rake might be made flexible instead of rigid. Elasticity may be of advantage. Rigid hydroplanes perhaps not necessary. Flexible hydroplanes of the hay-rake pattern would also serve as elastic sledge-runners to glide over ice or land and springs to break the shock of a 9 10 2 bad landing anywhere. Flexible rods or flat ribbons increasing in length from the body outwards might be of advantage (see G F ig. 2) as the hydroplane surfaces would diminish as the boat rises while the surfaces remaining in the water would be furthest removed from the body of the boat and thus increase its stability when elevated. As speed increases, the angle of attack would become less on account of the flexibility of the rods or flat ribbons, which would be advantageous for speed. At the same time, on account of the spring the angle of incidence would always be positive and could never become zero or minus. Use large surfaces to begin with and reduce afterwards. I think flexible hydroplanes are worth thinking about. If the springs are strong enough to support the boat on land they can never present a negative angle to the line of advance when in the water.

When a duck leaves the water do his legs trail behind him; and do his feet serve as hydroplanes to assist him in rising? A.G.B.

BALDWIN'S SUCCESS .

Beinn Bhreagh, Oct. 20, 1908: —At last after many discouraging experiences Mr. Baldwin's perseverance and pluck have met with the ri ir reward and on Oct. 20 his hydroplanes carried the Dhonnas Beag clear of the water with Mr. Baldwin on board (see photographs in this Bulletin). The boat did not rise under its own motive power or with the engine on board. It was towed by the motor boat Skidoo. The encouraging feature is that the speed required to cause the hydroplanes to manifest their lifting power 11 3 was not high. The Skidoo makes on the average about 7.6 miles an hour and the hydroplanes lifted at a less velocity than this. It is also encouraging to know that the thrust of the propeller to be used on the Dhonnas Beag ? i s more than twice as great as the strain on the towing line during the experiments Oct. 20. The pull was 50 lbs. and the thrust of the propeller will undoubtedly exceed 100 lbs. There can now be no doubt that Mr. Baldwin will succeed in converting his hydrodrome into a hydro-aerodrome which will rise from the water into the air and become the pioneer forerunner of a new type of flying machine. A.G.B.

THE ARMY

Beinn Bhreagh, Oct. 22, 1908 :—In response to my letter to the President of the United States (Bulletin XIII pp 32–33) I have received a communication from the Asst. Secre at ta ry of War to the effect that the War Department will detail an officer from the Signal Corps to be present in Hammondsport when the experiments with the new aerodrome are to be tried. I would suggest that both the June Bug and the Silver-Dart should be placed in condition for flight and that every information should be given to the officer who will succeed Lieut. Selfridge as the observer of our experiments in the interests of the United States Army. A.G.B.

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AERODROME NO.5 .

Beinn Bhreagh, Oct. 23, 1908: —The beading of the cellular part of aerodrome No. 5 has now been completed and the body section is being studied. A report upon the progress of No. 5 must be delayed on account of absence of room in this Bulletin. Mr. Baldwin's remarkable success with hydroplanes renders it advisable to make this a hydroplane number, and let other subjects take second place. I shall simply say, therefore, that a swinging seat has been placed within the body-study of aerodrome No. 5 (see Photograph appended) and that we are studying the question of the feasibility of working the front control by its means. A.G.B.

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TELEGRAMS FROM MEMBERS .

Aeronautic l a Society to Bell .

To A.G. Bell, Baddeck, N.S.

New York, N.Y., Oct. 9, 1908 :—Success of our exhibition November three depends upon your assistance. Can we rely on aeroplane. Please answer.

(Signed) Aeronautical Society.

Bell to Aeronautical Society .

To Aeronautical Society, New York, N.Y.

Baddeck, N.S., Oct. 10, 1908 :—Have no large kite. To assemble one impossible. June Bug in constant use. Regret inability to help.

Graham Bell.

Curtiss to Bell .

To A.G. Bell, Baddeck, N.S.

Hammondsport, N.Y., Oct. 20, 1908:— Dynamite charge effective. Results by mail. Manley wired as follows:—"If Committee announces contest for cup November three, will Association compete". He wants answer; advise us.

(Signed) G.H. Curtiss.

Bell to Curtiss .

Baddeck, N.S., Oct. 20, 1908: —Mr. Baldwin agrees with me that Association should not again try for the trophy until we have succeeded in flying the required distance in private, and we cannot interrupt our experiments to attempt this at the present time. Go ahead with the Silver-Dart and come down here as soon as possible. Hurrah for the dynamite.

(Signed) Graham Bell.

Bell to McCurdy .

Baddeck, N.S., Oct. 21, 1908 :—Notify Secretary of War when you are ready to try the Silver-Dart. Dept. will detail an officer to oberve the experiments. Yesterday Casey's hydroplane boat lifted more than a foot out of water with Casey on board but no engine. Towed seven miles an hour. Pull 50 lbs. Lift 300 lbs, and more. Success encouraging.

(Signed) Graham Bell.

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EXTRACTS FROM LETTERS FROM MEMBERS .

Curtiss to Aerial Experiment Association .

Hammondsport, N.Y., Oct. 6, 1908 :— Your message received. We are getting out sketch of the new 8 cylinder engine, together with description, as requested for the next Bulletin. We should be able to mail to-night.

Enclosed find a print of a group of famous aeronauts and motor-cyclists etc., and one of our testing frame for the double propellers. As you will notice these propellers are driven by “V” belts, both in the same direction. At the same engine speed these two propellers exerted a thrust of 50 pounds more than with the single propeller. The belts travelled nicely and caused no trouble.

In consideration however, of the danger of two propellers on separate axles, as brought home so forcibly recently, we have discontinued further experiments with this construction. G. H. Curtiss.

McCurdy to Bell.

Hammondsport, N.Y., Oct. 11, 1908 :— I have just been reading over the Aeronautical Annual with special reference to Mr. Chanute's article and in the 1897 number opposite page 156 is a diagram of the left wing of an Albatross. As I looked at it the shape struck me as being about the same in plan as the Wright's propeller. It has that curious sawed-off cutting edge after all. Also as Casey pointed out the little gliders we used up in the kite house at Beinn Bhreagh seemed to glide better with the point to the front. Would we be infringing 15 2 on the Wrights to try such a propeller.

J.A.D. McCurdy.

Curtiss to Aerial Experiment Association .

Hammondsport, N.Y., Oct. 14, 1908: — We enclose r p rints of the first two aeroplanes photographed together in America. The “June Bug” has been brought down and swung in the roof of the shed to make room for the “Silver-Dart” in the tent. We had some distinguished visitors yesterday, Mr. Schmidt of Washington, and a Mr. Saegmuller of the Bosch-Lomb Optical Co. of Rochester. Mr. Schmidt is one of the most wide-awake devotees to aviation we have met in a long time; he is also a good mathematician.

***The new engine is taking more time than we have ever required to build a new motor. As many men as can work are on it night and day. Everything is now here and it has commenced to assume form. Assembling will be finished this week.

G.H. Curtiss.

McCurdy to Baldwin .

Hammondsport, N.Y., Oct. 15, 1908 :— Read with interest your article in the latest Bulletin (XIV) on Cutting Edges. It is a pretty thing, but I was thinking over the same subject and noticed that the Wright's propeller which has that peculiar cutting edge is shaped like an Albatross' wing in plan. Would it not be a good scheme to utilize this principle on your hydroplane boat and make the planes a little aft so presenting 16 3 an angular cutting edge instead of a plane at right angles to the line of advance.

This might reduce the head resistance and not seriously affect the lift.

***The new engine will be ready to be assembled to-night and limbered up in the stand. It will then probably take a few days to refit the parts and re-assemble for tuning up. It certainly looks nice and if it developes the power we hope for, it will be a credit to the Curtiss Manufacturing Company, and Glenn can be proud of it.

***I received the promised articles from Mr. Chanute and am having a couple of copies made for our records as he wants me to return the original. I will forward you one to-night

J.A.D. McCurdy.

Curtiss to Bell .

Hammondsport, N.Y., Oct. 15, 1908 :— The New York World recently printed an article headed “Air Travel” and credited it to me, or I might better say “charged” to me. I enclose copy of what I really said, but it was hashed over and added to suit the Editor. The dictation may be worth using in the Bulletin.

G.H. Curtiss. (See article on “Future Air Travel” in this Bulletin).

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Curtiss to Mrs. Bell .

Hammondsport, N.Y., Oct. 16, 1908 :— Am sorry Mr. Bell could not have come to Hammondsport from Washington, and at least seen the “Dart”. We did not think it advisable to attempt flights until the new engine was ready; it could have been tried out with the old “June Bug” engine, but as so much was expected and so many newspaper men and others would be on hand for trials, we thought it would be better to wait until we were sure of accomplishing more than had been done with the June Bug.

The moving pictures of the June Bug flights are here, and will be shown for the first time to-night. I wish you could be here to see them. Perhaps we can get copies from the films which can be shown as lantern slides. While this would not be as good as the real moving pictures, it would give a succession of views which would show the action of the machine in the air. I would like to know if you have a lantern at Beinn Bhreagh. I remember of hearing of pictures being shown there last year.

G.H. Curtiss.

Curtiss to Bell .

Hammondsport, N.Y., Oct. 17, 1908 :—The enthusiasm for the flying machines in Hammondsport was greatly revived last evening by the exhibition of the moving pictures taken July 3–4 and 5. They were very good indeed, and I only wish there was some way we could send them to Beinn Bhreagh to be reproduced.

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Two flights were shown, together with pictures of the machine taken out on the track, testing the engine etc. Unfortunately the Aerial Experiment Association was not mentioned nor was Hammondsport. One section, however, was described as showing the “Curtiss 40 H.P. motor”, while Captain Baldwin and myself were announced to apear in another part.

A very touching incident was the life-like appearance of Tom and his dog Jack. Mr. Lyon of Rochester and Mr. Post are plainly seen, while Douglas in his knickerbockers is never out of focus. The boys who worked on the machine all appear true to life while the village urchins grinning faces show up in the fore-ground greatly to the delight of the audience.

The first announcement on the sheet was as follows:— “The great American Aeroplane, “June Bug” winning the American Trophy July 4, 1908. This announcement was printed around an outline drawing of an aeroplane in which the arched surfaces were most conspicuous.

I do not know if the pictures would be so interesting to a stanger who did not know the parties shown, although I hear that it has met with great success in New York.

I expect Monday to hear from the Aeronautical Society in reply to my letter of which I sent you copy yesterday. I will wire you what they say.

G.H. Curtiss.

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RESUME OF THE AERIAL EXPERIMENT ASSOCIATION AT HAMMONDSPORT: Report by G. H. Curtiss, Director of Experiments.

Before the Association Headquarters were transferred to Hammondsport, word was received to build a glider, the object being to gain some experience before building a power-driven machine.

This glider was built of bamboo and sheeting, and practiced with at various times for the first 60 days, many successful glides being made, some by each of the members. In the meantime, the power-driven machine was started, it being the majority of opinion that greater progress could be made by going at once to the power-drive and practice on the ice. This proved true, although considerable knowledge was gained with the gliders, which were tried with many different forms of tail and control.

The first power machine was Selfridge's “Red Wing”. In its first trial Mr. Baldwin made a flight of 320 feet. This was the first public flight of a heavier-than-air machine in America, and the longest first trial ever made by any heavier-than-air machine.

At the second trial of this machine, again ridden by Mr. Baldwin, the strong wind proved too much for the limited controlling surfaces, and the machine was wrecked. By this time the ice had gone, and a machine to run on wheels was built and called Baldwin's “White Wing”. This was fitted with adjustable wing tips and several types of running gear were tried. Several successful short l f lights were made by members of the Association.

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2 This machine was finally smashed, and a third one called Curtiss' “June Bug” was built to try for the Scientific American Trophy. This machine embodied features of the “Red Wing” and White Wing with improvements, and contained many original ideas, including bowed surfaces, adjustable wing tips and shoulder control, combination steering wheel and the three wheel running gear with auxiliary skids.

On July 4th the Scientific American Cup was won by Mr. Curtiss, covering a kilometer and as much more as the boundaries of the field would permit, something over a mile altogether.

The machine was then experimented with, and further improvements made and embodied in McCurdy's No.4, “Silver-Dart” which is completed and ready for the engine. The new type of engine is of great power and endurance and has been designed for this machine, which should be a “world beater”.

This, together with the propeller experiments, and some kite flying in the early Spring, covers roughly, the work of Hammondsport. Besides what has been given the world, and recorded by the Association for future reference, the members have gained a knowledge of aeronautics which, if applied, should be of great benefit to the Art. G.H.C.

The attached letter from Mr. Dienstbach describes the A.E.A.'s aerodrome as seen by an outsider. G.H.C. (this appeared in Bulletin XIII pp 33–36).

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THE NEW MOTOR: By G. H. Curtiss.

Hammondsport, N.Y., Oct. 7, 1908 :— The new eight cylinder 50 H.P. water-cooled motor being built for the A.E.A. differs from any motors previously built by this company in as much as it is water-cooled, and is of larger cylinder dimensions; the bore is 3 ¾“ and the stroke 4“.

The cylinders are placed in the form of a “V” four on a side as shown in the sketch, which also gives other dimensions.

This motor has mechanical intake valves and is built for durability and constant hard running. The engine alone will weigh about 175 pounds. G.H.C.

(A blue print of the motor is appended.)

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8 CYLINDER 50 H.P. WATER-COOLED ENGINE FOR SILVER DART.

23

FUTURE AIR TRAVEL: By G. H. Curtiss.

The theory upon which many aviators are working is that the long narrow surfaces are most efficient, but with this form of surface the weight increases in greater proportion than the lifting power and the structure becomes weaker as its size is increased. It is this difficulty which is overcome by means of Dr. Bell's tetrahedral construction. This construction with its many small dihedral surfaces, also bids fair to solve the problem of stability.

The areoplane of the future may furl and reef its surfaces much the same as a ship's sails are adjusted to the conditions of the weather. Much higher speed will be made in the aerial flyers of the future than is now accomplished on land, because it will be necessary for these flying crafts to maintain a high speed in order to fight the wind. A light motor and a propeller of great efficiency will do much toward the practical development of the present aerodrome. This improvement of the surfaces is already being rapidly accomplished.

One of the diff c i culties now experienced, and which was illustrated at Fort Meyer, is the loss of equilib i r ium. It is possible that the gyroscope will be brought into play to overcome this, but it is hardly probable that automatic equilibrium will ever be entirely attained.

Balloons and dirigibles have been of vast service in learning the peculiarities of the air, but within five years the heavier-than-air machine will have nearly replaced the lighter-than-air craft. The future aerial craft will be simply a development 24 2 of what we know already. It is safe to say that there will be for several years great improvements in the motor balloon and the aeroplane, but there will be no combination of the two as has been predicted.

The airship which, within ten years, will carry men and freight from place to place, will be a natural evolution of the aerodromes of to-day and not the semi-accidental discovery of a genius. It will be the work of a man who is thoroughly familiar with the laws of fluid movement; with the effects of wind currents and the means of overcoming the numerous difficulties which are encountered in the air. It is in the practical application of the scientific knowledge at hand that the solution of the problems of aerial flight will be found. G.H.C.

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BALDWIN'S EXPERIMENTS WITH HYDROPLANES OCT. 16, 1908: By Gardiner H. Bell.

Beinn Bhreagh, Oct. 16, 1908 :— In the experiments made to-day the Dhon m n as Beag was stripped of the engine and towed without a man on board by the motor boat “Skidoo, being steered from the Skidoo by chords attached to the extremities of the outriggers. Total weight about 100 lbs. The Skidoo made an average speed of 600 m in 174 sec, or 7.6 miles per hour.

Exp. 1 (Morning) She lifted practically clear out of the water running on her planes. Two sets of hydroplanes fore, and one aft. Pull 25 lbs.

Exp. 2 (Afternoon) The boat was tried with the same outfit as in the morning but an extra set of hydroplanes of only two blades was used aft. Result about the same as in Exp. 1. Pull 20 to 30 lbs.

Exp. 3 Boat was then taken out of the water and the new set of hydroplanes were attached. (Photograph not shown in this Bulletin). The boat with new hydroplanes weighed 140 lbs. In this experiment the efficiency of the new hydroplanes was shown by the boat lifting high out of the water in the rear. The new hydroplanes buckled on the port side.

Exp. 4. Boat was again hauled out of water and two fish-shaped struts were used one on each side of boat, to strengthen the hydroplanes. Also the rear hydroplanes of two blades was taken off. Again she lifted out of the water in the rear. She also had a decided lurch to starboard. Pull 50 lbs.

26

2 Exp. 5. Mr. Baldwin then got on board the Dhonnas Beag to try and steadyher, making the total weight exceed 300 lbs. She did not lift from the water and the starboard strut pulled out and the port hydroplane again buckled notwithstanding the strength given by the extra strut.

A note by Mr. F. W. Baldwin dated Oct. 17, 1908, says:

Yesterday (Friday Oct. 16) tried Dhonnas Beag towing her behind Skidoo. Three sets of hydroplanes first two forward and one aft; no engine and no man. The total weight was about 130 lbs. She lifted forward but stern dragged in the water so attached another set of hydroplanes well aft. This time boat lifted practically out of water; speed 100 meters 30 sec; pull 25 lbs. A slight pull on the line would lift boat clear out of water, so that you could see right under fore a t o aft.

Then we put on new hydroplanes leaving on the other four. Weighed about 140 lbs with the hydroplanes. She lifted way up by the stern, port side of new hydroplane. Put a fish-shaped strap on each side to strengthen the hydroplanes and took offplanes aft of the new ones to try and make boat balance. Boat still lifted by the stern. 100 meters in 30 sec; pull 50 lbs. Then I got on hydroplanes on the boat to try and trim her. 100 meters in 29 sec down. 100 meters in 30 sec up. Pull 70 lbs. Boat lifted, but not clear of the water. Starboard strap pulled out, and on taking boat out of water, found port side of planes buckled again.

I append these notes as they are important as coming from Mr. Baldwin himself.

G.H.B.

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BALDWIN'S EXPERIMENTS WITH HYDROPLANES OCT. 17, 1908: By Gardiner H. Bell

Beinn Bhreagh, Oct. 17, 1908 :— There is a noted difference in the experiments made yesterday and to-day from those of the past, in that the Dhonnas Beag was stripped of all her weight, engine and man, and was towed by the launch “Skidoo”; whereas heretofore she was driven by her own motive power and did not succeed in rising on her hydroplanes. The Skidoo made an average speed of 1000 meters in 307 seconds.

Exp. 1. Besides making the boat as light as possible the lifting surfaces of the forward hydroplanes were greatly increased by the use of a wooden hydroplane, about three inches wide inclined at an angle of 5°, which was lashed on below the two forward hydroplanes. (See photograph in this Bulletin). In the stern was a four-bladed hydroplane, and about three feet forward of this was another hydroplane of three blades.

Result: Boat lifted completely out of the water and ran along on her hydroplanes steadily, keeping the hull at least a foot clear of the water. She was inclined to be a bit heavy to starboard so a piece of lead was put on the port outriggers to counterbalance the effect. This had the desired effect. During the experiment the pull registered 50 lbs.

Exp. 2. As she was inclined to lift too high in the bow she was loaded down with 46 lbs. of lead well forward about three feet behind the forward planes.

Result: She took on a diving action, resembling that of a porpoise. Pull 50 lbs.

28

2 Exp. 3. The lead was shifted at lower end of course about three feet farther forward, bringing it immediately above forward plane. With this balance she plunged more severely than before.

Exp. 4. Load shifted away aft, with the result that the boat lifted away out in the bow.

Exp. 5. Again the weight was shifted forward about a foot and a half bringing it nearly amidship.

Result:— She dove up and down with above adjustment.

Exp. 6. The weight was then removed and Mr. Baldwin got aboard the Dhonnas Beag. With his weight the boat did not lift out of the water. Pull registered 85 lbs.

Exp. 7. Mr. Baldwin then got off and the 46 lbs weight was placed as far forward as possible. With this adjustment she jumped up and down, the whole boat keeping parallel with the water.

Exp. 8. Again weight was shifted back about a foot. She still continued to dive badly.

Exp. 9. Shifted weight three feet forward of center of gravity. Jumping action parallel with water.

Exp. 10. Shifted weight three feet back of center of gravity. Held her nose steadily high out of water. Pull 70 lbs.

Exp. 11. Shifted weight to center of gravity. Plunged up and down in the bow. Pull varying from 40 to 60 lbs.

Exp. 12. Weight was then taken off. She rose out of the water a foot fore and aft and stayed there.

G.H.B.

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212. Taken 1808 Oct 19 th Smd ?ew. 1808 Oct 20 th Smd

30

Taken 1808 Oct

211

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BALDWIN'S EXPERIMENTS WITH HYDROPLANES, OCT. 20, 1908: By Gardiner H. Bell.

Beinn Bhreagh, Oct. 20, 1908 :— In experiments to-day two wooden hydroplanes were used, instead of one as in the last experiments reported, one fore and one aft. Each plane was lashed on to the bottom of two sets of the regular iron hydroplanes.

Exp. 1. The Dhonnas Beag immediately upon gaining headway, went up on her hydroplanes and stayed there as long as headway was maintained. Some difficulty was found in keeping her on an even keel and she drifted badly from side to side.

Exp. 2. Two strips of wood, one on either end of the outriggers were tried as a means of steadying her. (See photograph). 46 lbs of lead was put amidship. She lifted high out of the water, but it was very hard to steady her in this position.

Exp. 3. Mr. Baldwin then got on board the Dhonnas Beag. As soon as sufficient headway had been gained by the launch the Dhonnas Beag came out of the water on her hydroplanes holding the boat a foot clear of the water until speed was slackened.

In above experiment:—

Pull 52 lbs. Speed 100 m in 35 sec down

Pull 42–50 lbs. Speed 100 m in 32 sec up.

200 m in 67 sec.

This was a red-letter day at Beinn Bhreagh. Present as witnesses:— Mrs. A.G. Bell, Miss Mabel B. McCurdy, Dr. A. G. Bell, Mr. F. W. Baldwin, Mr. Gardiner H. Bell, Mr. Bedwin 32 2 and members of the Laboratory Staff including Messrs. Malcolm MacFarlane, John MacLean, Wilson Rudderham, and William MacDonald. G.H.B.

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A STEP IN ADVANCE: By F.W. Baldwin.

Tuesday Oct. 20, 1908, marked a new phaze in our hydroplane experiments. Previous to this our hydroplanes have not yielded results definite enough to make deductions from, or reliable enough to base calculations upon.

The retarding effect of the hydroplanes upon the boat was the only action we were perfectly sure of. The lift being a very uncertain quantity while any part of the hull remained in the water.

On Tuesday Oct. 20, however, we succeeded for the first time in lifting the hull and a man well out of the water, so that at last we have a pure hydroplane action, and a means of measuring accurately all the factors involved.

With the planes set at 5° (Angle of incidence) and an average pull of 50 lbs. the lift was 300 lbs. This result while in no way remarkable is nevertheless promising. Taking the lift/drift as the measure of efficiency we get 300/50 = 6, which means that even with the crude planes employed in this experiment, we can lift a boat clear of the water with a propeller thrust equal to # of her displacement. Once a hydroplane boat under her own power can lift clear of the water i.e. (substitute the vertical pressure of the planes for displacement) we have every reason to expect, both from theory and practice, that the high speed we have been looking for is obtainable.

Of course a great many improvements over the planes used at once suggest themselves. For example:— The cutting edges of these were at right angles to the line of advance; 35 2 their head resistance unnecessarily large, and their curvature too flat for efficiency. In all these particulars we expect our new metal planes to be an improvement. They present only slanting cutting edges, and are much finer in section.

However this may be, we have now something satisfactory to work from, and it is encouraging to note that even with our present inefficient planes, we have at our command the necessary propeller thrust to lift the Dhonnas Beag out of the water, and convert her from a boat to a hydrodrome.

It might be well for us to ?now give some thought to the stability of such a machine. The boat, at present of course is very unstable when the hull is well above the water. While it travels smoothly when balanced it has no automatic stability and it requires a lot of attention on the part of the operator to keep her on an even keel. Probably a dihedral angle on some of the planes might be used to remedy this defect, or Dr. Bell's suggestion of using planes on the hay-rake principle. In any case lack of stability with the hydrodrome is not attended by the same danger or difficulty as with the aerodrome. Let us get out of the water first, and seek stability afterwards.

F.W.B.

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DISCUSSION CONCERNING FRONT AND REAR CONTROLS OCT. 14, 1908: Report by Mabel B. McCurdy, Stenographer of the Association.

(Report of the Stenographer revised for this Bulletin).

Beinn Bhreagh, Oct. 14, 1908 :— Dr. Bell read to Mr. F.W. Baldwin and Mr. Gardiner H. Bell his note upon "Front Control" given elsewhere in this Bulletin; whereupon the following discussion took place:—

Mr. Baldwin :— In the first place I think the aerodrome with its front control is not comparable to a pole with one surface on it. There are two surfaces on the pole that would represent the machine. The main surface is behind the center of gravity, or whatever point you want to take as a pivot.

I think one of the greatest things about a bow control is that you can see what you are doing, that makes up for a great many deficiencies, having the whole control in full view and seeing exactly what it is doing. In fact, I think, all steering or working parts should, if possible, be in full view. If your bow control breaks, why you would know where you are! When the Red Wing tail broke I did not know it had broken at all. You want to get your moveable parts in front where you can see them. You can make your truss strong, you can make your rigid parts strong; the things that go wrong are your working parts. Now the Red Wing certainly broke her tail on one side. Everybody excepting myself knew it, but I didn't until I came down on the ice. Now I should have seen it had it been in the bow. It is perfectly possible for a tail to break and operator not to know enough to shut off when to 37 2 shut off might save his life. An accident to the stern might cause you to lose control of the whole machine and you might not know what was wrong.

The dangerous thing is loss of headway. In all our machines that is the only thing we have to fear very much. As long as you have good steerage way you won't have a very bad fall. If you lose headway, I think a bow control is a safer proposition than a tail because your center of pressure, when in flight at small angles, is well forward. Your weight has to go forward when you speed up. You must either have your center of gravity well forward of the center of surface or else shift the controlling planes to meet it. You could have your center of gravity somewhere near the center of surface of the machine and control the travel of the center of pressure by using your front control at a negative angle and then if you lose all headway your machine is nicely balanced for a slow glide, the center of gravity being very little in advance of the center of surface. I think the safest possible proposition would be a good big bow control on a good long arm and travel with it at a slightly negative angle.

Dr. Bell :— Then I understand that you admit the main proposition, about the pole with a horizontal surface at one end to be correct, but think that the main surface of the aerodrome being back of the center of gravity, renders the two cases not comparable, that in fact in the aerodrome case, you have two surfaces, one in front and the other behind the axis of turning, and the one behind very much larger than the one in front. But in this case the main surface which is supposedly 38 3 back of the axis of rotation is inclined with its rear edge downwards. In other words it is tilted up in front. Thus so far as its action as a rudder is concerned it would tend to make the machine dive—

Mr. Baldwin :— No, no it balances all right. They are not tending to thus turn the machine over. If the center of gravity is right under the center of pressure there is no turning tendency.

Dr. Bell :— Yes, but if the surfaces are back of the center of gravity why is there not a turning tendency, why don't they act like a rudder steering the bow down under headway.

Mr. Baldwin :— Because the part behind is not as effective.

Dr. Bell :— Well, anyway now you admit the main proposition, but don't think that the two cases are quite comparable, that there is not a single surface away out in front. As I gather your idea, the front control would be, you think, a more efficient safeguard in case of loss of headway than a rear tail.

Mr. Baldwin :— Yes.

Dr. Bell :— Now let us look at that. We lose headway and under these circumstances neither a front control nor a rear tail will operate to direct a machine.

Mr. Baldwin :— I don't think that is quite correct.

Dr. Bell :— No rudder will work without headway. Now we lose headway and the machine begins to drop under the action of gravity. Then we have “downway”, not “headway”, and in the interests of safety is it not advisable that the machine should 39 4 turn head down rather than tail down? Now the effect of a single surface away out in front would, under the influence of downway tend to send the head up, and lead to a stern fall. Whereas the influence of a rear tail would be to elevate the stern and lead to a dive with subsequent recovery of headway when the machine would be again under control. I speak here of the tendencies of the front or rear controls. You introduce a new element and place the center of gravity in front of the center of surface so that, under the influence of gravity alo l n e, the machine will dive when headway is lost, and then claim that the front control is safer because its tendency to turn the head up, when dropping, neutralizes to a certain extent the tendency of gravity to turn the head down. Whereas the influence of the rear rudder tends to make the dive greater. So that your proposition is that the front control, combined with an advance in the center of gravity, is safer than a rear control, combined with an advance in the center of gravity.

Mr. Baldwin :— That is it in a nutshell. They are equally safe if you have a long enough distance to drop; but if you have only got a short distance it is much better to have a machine with which you could regain steerage way more quickly. Now I think you can regain steerage way more quickly and without such a steep di c v e, when you have a bow control and preferably carry it at a slight negative angle. In all our machines the center of gravity must be well forward of the center of surface of the machine.

Dr. Bell :— Why?

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5 Mr. Baldwin :— Well, because as a machine travels at an increasing speed and a less angle of incidence, the center of pressure does move forward, we know that. Take any of our machines and balance them up, put your center of gravity underneath the center of surface of the machine. Now propel that at any small angle of incidence, and it won't balance. The bow goes up. With the surfaces we have used the center of pressure moves forward almost to the front edge of the machine. About 8 inches back was a fairly good balance for the center of gravity. Now the planes are 6 feet deep so that we know that the center of gravity must be well forward on the machine to balance it when in motion. Now when the machine hasn't any headway with that balance, if you suspend the machine, and let it suddenly drop it will take a very bad dive, and then recover headway. Just like the little gliders it would go along and dive, then go along and dive again etc. etc. Now you

can have the center of gravity further back in the machine if you have a front control at a negative angle.

Suppose you have a tail and lose headway. Then under the influence of downway the action of the tail turns the stern up increasing the tendency to dive.

Mr. Gardiner Bell :— That tail isn't going to make your action any worse, on account of pressure on the upper surface of the tail resisting turning action.

Mr. Baldwin :— You don't get pressure on the upper surface until you have headway, and you don't get headway until you have downway.

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6 Now let that machine drop, it will tend to dive more speedily with this tail on. With a bow control it tends to check the dive.

Dr. Bell :— You think the pressure is on the under surface of the tail, Gardiner Bell thinks it is on the upper surface.

Gardiner Bell :— You take both cases, one machine with a tail, and the other without; you can turn the machine without the tail quicker than the one with the tail. The resisting pressure will be on the upper surface of the tail the moment the machine turns, that is if the tail is fixed or stationary.

Mr. Baldwin :— According to Dr. Bell's proposition the thing with a tail let free to fall will tend to do the weather vane act and drop with its head vertically downwards.

Dr. Bell :— I think we are all agreed upon the point that the principal danger to the aviator is in loss of headway. Now in all machines so far made the center of gravity is in front of the center of surface so that when we lose headway the machine dives and the front control by its resistance tends to check that dive. It is equally obvious that if the center of gravity was behind the center of surface then the rear tail would check the stern dive which would result? But the question comes in my mind why do we have to have that center of gravity in front of the center of surface, why would it not be safer, without headway, to have it directly under the center of surface. Suppose the reason to be, and I think it is right, that when headway is gained the center of pressure moves forward and we have to have the center of gravity under the 42 7 center of pressure in order to balance. Then the faster the machine moves and the slighter the angle of the main planes with the line of advance the more the center of pressure moves forwards, which would mean that the center of gravity also has to move forward to balance the machine.

Now are we not going on the wrong principle altogether to balance an instability that results from a change in the center of pressure, by making a change in the center of gravity I think the Wright Brothers introduced an enormous improvement over the acrobatic method of Lilienthal when they proposed to counterbalance such changes by the action of moveable surfaces Why would it to be better in this case also to have the center of gravity under the center of surface, the safest position without headway, and counterbalance the effect of the movement of the center of pressure by means of moveable surfaces.

We have hitherto been considering the front control versus the tail. Why not have both together? They can co-operate with one another in steering under headway and would not both be safer than either alone in coming down without headway?

Mr. Baldwin: — I think that is all right. That is exactly what I mean by carrying the bow control at a negative angle to leave your center of gravity somewhere near the center of surface, although in advance of it so that if you do lose headway you are in a better position to control the dive.

Dr. Bell :—There is a great deal in Gardiner Bell's idea. Under a vertical drop the pressure of the air acting on 43 8 the under surface of the tail would of course tend to push the tail up. But the actual effect depends very largely upon where the center of gravity is. If the center of gravity is directly under the center of surface of the main planes the tail would undoubtedly act in that way. But if the center of gravity is in advance of the center of surface of the main planes then the resistance of the air on the upper surface of the tail would lessen that tendency to turn, and so would the resistance on the lower surfaces of the front control, and both of them together, resist the turning tendency resulting from the eccentric position of the center of gravity. The axis of rotation in this case being the center of surface, or center of resistance.

Mr. Gardiner Bell : Why not use your tail for a sustaining surface as well as a tail? The front control evidently is a good thing because it does things quickly; but why not limit the bow control by using a rear tail and then too you can put your center of gravity away back. Then you have your front control, and your rear tail helps to sustain as well as keep your equilibrium. There is a certain amount of sustaining surface in the tail because you move your center of gravity further back, and also, I think, the only place you can have your control is in front, but the tail limits the front control so it is not such a dangerous thing in the hands of the operator.

Mr. Baldwin :—Mighty good thing to check you up just the same. It gives you the ability to recover quickly.

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9 Mr. Gardiner Bell : And it really does not matter how far back you put your tail does it?

Mr. Baldwin: You bet your life it does! Anything behind the propellers is a bad proposition. There is a draft of air from the propellers upon any rear surfaces, and if they are inclined so as to be supporting surfaces, then when your propellers stop the change in the balance of the machine might be very great.

Mr. Gardiner Bell :— In that case it would be a good scheme to put your rear tail further back.

Mr. Baldwin : There is a drag to the tail though.

Dr. Bell:— This is shown in the Hammondsport experiments. The speed of the June Bug was greatly increased by the omission of the tail. There is one consideration you can get great longitudinal extension by using both the front control and the rear tail, and at the same time get quick action by using them simultaneously.

Mr. Gardiner Bell: Mr. Baldwin's idea of having the front control at a negative angle so as to intensify the safety seems to me to be wrong in principle.

Dr. Bell:— Why?

Mr. Gardiner Bell : Because there is nothing that brings about resistance so much as that.

Dr. Bell:— That is, introduces an artificial resistance to advance.

Mr. Gardiner Bell : That is what I mean.

M.B. McC.

45

THE STABILIZING EFFECT OF THE STATIONARY TAIL: By Gardiner H. Bell.

Beinn Bhreagh, Oct. 14, 1908 :— One of the great problems seems to be, where to put the horizontal control, or controls, and whether or not to use a tail.

Undoubtedly the front control is the most effective, and for this reason, if not handled properly is the most dangerous. It can cause a fore-downward plunge quicker than anything. But it can also check a plunge more effectively than a rear control. The action of the front control, however, is limited by the position and area of the tail, supposing there is one.

For example a horizontal tail ten feet in the rear of the machine will have a more stabilizing effect than a tail five feet in the rear; the cause for this is leverage. Hence the power of a front control will be less in the first case than in the second.

In case I then, the force and aft stability will be increased and the power of the front control will be diminished. It is obvious that with a stationary tail the horizontal control must be in front. You don't want to increase your sustaining area from fore to aft, but you do want to increase your stability. Hence why is not a stationary horizontal tail, say fifteen feet in the rear a good thing? G.H.B.

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LOEB TO BELL .

White House, Washington, D.C., Oct. 8, 1908 :— Your letter of the 5th instant has been received and by direction of the President has been called to the attention of the Secretary of War.

Wm. Loeb, Jr., Sec. to the President. (See Bulletin X ? I II pp. 32–33 for letter to President Roosevelt).

ASSISTANT SECRETARY OF WAR TO BELL .

War Dept., Washington, D.C., Oct. 17, 1908 :— I have the honor to acknowledge the receipt, by reference from the White House, of your letter addressed to the President under date of 5th instant, regarding work of the Aerial Experiment Association, and to express appreciation of your courteous offer in placing the technical information of this Association at the disposal of the War Department.

The different types of aerodromes which the Association has available have been noted, and an officer will be detailed from the U.S. Signal Corps to witness special flights of aerodromes at Hammondsport, N.Y., in accordance with your suggestion, upon being informed of the dates upon which such flights are to take place.

The death of the young officer referred to by you is deplored by all.

Ro v b ert Shaw Oliver, Assistant Secretary of War.

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THE PHILLIPS FLYING MACHINE.

(See Aeronautical Journal July, 1908).

It is interesting to note the experiments of an English inventor, who has, for some years been working on a machine of an entirely different type from those which are now claiming our attention.

Experiments were first made with a model in 1893 by Mr. Phillips. The sustaining surfaces consisted of a series of planes assembled in such a way as to resemble venetian blinds. There are over fifty of these slats, each 22 feet long and 1 ½ inches wide. They were slightly concave and tilted at about two degrees with the horizontal.

In general dimensions the machine was 25 feet long, breadth, 22 feet, and 11 feet high. The total weight, including load was 420 lbs.

The machine was mounted on three wheels, the single wheel leading. The propeller which was 6 feet in diameter had an eight foot pitch and developed a thrust of about 75 lbs. the motor power used was steam, the engine developing about 8 H.P., and weighing 200 lbs. Coal was used for fuel; the machine was started on a circular track about four feet wide.

It was governed by a wire running from the machine to the center of the circular track. During one trial the machine supported itself in the air for about 2000 feet flying about four feet above the track.

Mr. Phillips was so encouraged by these experiments that in 1907 he constructed a much larger model.

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2 In this machine the principle involved is the same but instead of having only one set of sustaining surfaces, arranged like venetian blinds, there are four of these sets on frames arranged one behind the other. The total weight of the machine is 500 lbs. The motor develops about 20 H.P. The propeller used is seven feet diameter. G.H.B.

THE KIMBALL HELICOPTER .

(See Aeronautics for Sept).

Above the Chassis, which consists of three wheels, a light framework, and a four cylinder 50 H.P. water-cooled engine is a system of propellers in a very light framework, inclined at an angle of about 20 degrees with the horizontal. There are twenty of these propellers, each propeller having four blades. Their diameter is four feet and their pitch is very low. They are to be run at 1000 revolutions per minute. G.H.B.

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297 Taken

228 Taken

BULLETINS OF THE Aerial Experiment Association

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ASSOCIATION'S COPY.

BEINN BHREAGH, NEAR BADDECK, NOVA SCOTIA

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Bulletins of the Aerial Experiment Association .

BULLETIN NO. XVII ISSUED MONDAY NOV. 2, 1908 .

Beinn Bhreagh, Near Baddeck, Nova Scotia .

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Mauro, Cameron, Lewis & Massie to Bell .

To Dr. A. G. Bell, Baddeck, N.S.

Washington, D.C., Oct. 10 ? , 1908: — We have yours of the 5th inst. with enclosed note by Mr. Edmund Lyon, and the article by Mr. Carl Dienstbach, and as you surmise, these notes will be of value of Mr. Cameron in the preparation of the specification.

Mr. Cameron has had a long interview with Mr. C. J. Bell in regard to the business situation and as to the course to be taken in the execution of the specification. In this connection, Mr. Bell got the original written agreement of the Aerial Experiment Association, in which occurs the clause that all of the members of the Association are to be recognized as joint-inventors. Probably the intent of this clause was to the effect that all of the members of the Association were to be recognized as joint-owners of any inventions that were made by the members of the Association during the life of the Association. The question as to who are and who are not joint-inventors is one that is determined by the law, and cannot be fixed by members of the Association by simply executing art c i cles of agreement to any particular effect, though you can agree, for example, that the invention of one of you shall be the joint property of all of you. Still, under the law, the application would have to be made by the individual who was the inventor. This brings us to the consideration of the question as to who is to execute the application in the present instance. It must be executed by each of those who contributed any of the inventive ideas which are to be covered by the claims of the patent. 2 2 By inventive ideas we do not mean simply a suggestion that it might be well to do one thing or another, but the conception of the means by which the desirable thing is accomplished. If any of the particular means employed in your structure, and which are to be covered by the claims, originated with Lieut. Selfridge, then Lieut. Selfridge must be recognized as a joint-inventor, and to fail to do so would be to jeopardize the validity of the patent. The same is true as to each and every one of the other parties of the Association.

On the other hand, it would be equally as fatal to include as a joint-inventor someone who did not contribute any one of the actual inventive ideas to be protected but the claims of the patent. Mr. C.J. Bell seems to have gained the impression that the structure to be patented really originated with yourself and Mr. Baldwin, and that the others were keenly interested in the success of the enterprize and offered suggestions of one kind or another, and worked earnestly and conscientiously to help make the enterprize a success, but that they did not originate any of the ideas which are to contribute to the subject-matter protected by the patent. If this is correct, then yourself and Mr. Baldwin would be the joint- inventors, and only yourself and Mr. Baldwin would need to execute the application. Mr. Cameron's understanding of the matter however, is not in accord with that which seems to be entertaine by Mr. C.J. Bell. On the occasion of his visit to Hammondsport Mr. C. recognized the fact that the question of inventorship was liable to be a complicated one, and took occasion to closely 3 3 question all of the gentlemen there, including Lieut. Selfridge, and it seemed to be the unanimous opinion of those gentlemen that the structure was the result of the joint mental and mechanical efforts of all of the members of the As A s ociation, and that it would be very difficult, if not well-nigh impossible, to state just what particular parts were contributed by the several individuals, with the exception of one or two prominent features. All were working together for the accomplishment of the desired end, one suggesting one thing and one another, and the result of the joint efforts of all, gradually developed and evolved after months of work, was the June Bug. If this be the correct statement of facts, then all the members of the Association are joint inventors, of which Lieut. Selfridge is one, and it will be necessary that an executor or administrator of his estate be appointed, such executor or administrator to execute the papers. While it would be desirable to avoid this complication still if the facts are in accordance with Mr. Cameron's understanding, it is the only safe course to pursue. If they are not in accordance with Mr. Cameron's understanding, but are as Mr. C.J. Bell understands the matter, then the specification should be executed only by yourself and Mr. Baldwin, and then assigned to a Trustee to hold in trust for the members of the A.E.A.

Mr. C.J. Bell informed Mr. Cameron that at a meeting in this city, the members of the Association agreed to extend the time limit of the agreement for six months from Oct. 1, 1908, which would carry the time to the first of April 1909, and that such agreement was recorded in the minutes of the 4 4 meeting held here in Washington. The best way to accomplish such an extension would be to simply endorse on the outside of the present original agreement the following: “The term of this agreement is hereby extended to April 1st, 1909”. and this endorsement should be signed by each memebr of the Association.

We do not think it need be signed bya?y representative of Mr. Selfridge, since Mr. Selfridge's contribution to the enterprize necessarily terminated with his death.

When the specification and claims are laid before you, you will be perhaps better able to decide as to general inventorship by a careful consideration of the subject-matter claimed and a discussion of the whole situation with Mr. Baldwin and Mr. McCurdy.

(Signed) Mauro, Cameron, Lewis & Massie.

Bell to Mauro, Cameron, Lewis & Massie

To Mauro, Cameron, Lewis & Massie, Washington, D.C.

Baddeck, N.S., Oct. 29, 1908 :— Your note of Oct. 10 was received in due course and contents noted.

Please forward specification and claims as soon as possible. When we know what the claims are we can better take up the question of specific inventorship.

(Signed) Alexander Graham Bell.

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Mr. Charles J. Bell to Bell .

To A.G. Bell, Baddeck, N.S.

Washington, D.C., Oct. 8, 1908: — I had quite a long interview this morning with Mr. Cameron in relation to aerial matters. He appears to have quite a grasp of the situation, and to understand very thoroughly the various points brought out in your memorandum.

I have requested him to go ahead and prepare a skeleton of the ap l p lication to be made for a patent, and as soon as it is finished he will forward same y t o you for criticism and advise. I showed him the agreement which was entered into between yourself and the other members of the Association in September 1907.

The wording of that agreement is a little unfortunate, it is headed, “Agreement to organize the Aerial Experimental Association”, and all the way through apparently contemplates some other paper to be drawn to complete the organization.

The language used should have been “we hereby associate ourselves together” instead of “hereby agree to associate ourselves together”. In another paragraph it states “we agree that the Aerial Experimental Association shall be organized on the first day of October, 1907, and shall exist for one year”. Another paragraph says “any applications for letters patent shall be made in the names of all the members as joint-inventors”, this is contrary to law. An application for a patent must be made by the inventor, or inventors, and not signed by any other person. It is of course quite possible 6 2 to have a patent application signed by a number of persons who have each taken part in the invention, but they cannot sign the application as joint-inventors, simply because of an agreement which stated they should do so, whether they really are participants in the invention or not.

The first question for you and the other gentlemen interested to decide and advise Mr. Cameron of is, did Lieut. Selfridge contribute towards the inventions which you propose to be patented, if so, he should join, and being dead, his place should be taken by the legal representative of his estate. If, however, he was not actually one of the joint-inventors his signature would not be proper on the application, even though you had entered into an agreement to the effect that he should sign. The mere fact that he did not sign the application would not in any way prejudice his right to participate in the result of the inve t n tion which is covered by the terms of the agreement. In any case it is absolutely necessary that an administrator should be appointed for his estate, and steps for this purpose should be taken without delay.

The agreement contains a clause that it shall remain in effect for one year from the date of organization, unless otherwise determined by the unanimous vote of the members. This apparently contemplated, not an extension of the agreement, but that it might be terminated prior to one year, provided unanimous consent was given.

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3 I wish therefore you would send me a copy of the minutes of the meeting held in Washington September last, by which you agreed to make a further extension for six months, as I should recommend that such an agreement be put in writing and made part of the original contract with the signatures of all the parties interested thereto.

Undoubtedly any interest of Lieut. Selfridge whether such interest was obtained as one of the joint-inventors or as joint-owner in the patents, might for government use be claimed as property of the United States, he having acquired such interest while in the line of duty. This, however would not give the United States a right to claim the use of the machine without first compensating the other owners. It might, however, enable them to tie up the business of the Association if they desired to do so.

I have hurriedly taken up the points talked over with Mr. Cameron. I was very much pleased with the study he had made of the entire subject, and believe that he will prepare specifications which will meet with your approval.

(Signed) Charles J. Bell

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Bell to Charles J. Bell.

To Charles J. Bell, Pres. Am. Sec. & Trust Co., Washington, D.C.

Baddeck, N.S., Oct. 29, 1908 :— * * * The question of inventorship is going to be a very complicated one, as the idea of the Association was joint work; one member would contribute one idea, another ano ? t her, until really it is going to v b e very difficult to decide who were, or who were not participants in the development of any specific idea.

Of course the inventions will be limited to the claims and when we receive from Mr. Cameron a copy of the claims he proposes to make we can more hopefully look into the question of inventorship of those specific points.

Curtiss and McCurdy will be here soon so we will be all together by the time the claims can arrive here.

You will find in the Bulletins which have been sent to you an account of the Washington Meeting in September last.

You speak of the absolute necessity of having an administrator appointed for the state of the late Thomas E. Selfridge. None of us know how to go to work upon this matter, and we would all be very much obliged if you, as Trustee of the Association, could take up the matter with Mr. E.A. Selfridge father of Lieut. Selfridge. His address is 2615 California Street, San Francisco, California. * * *

(Signed) Alexander Graham Bell.

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THE ADAMS COMPANY TO BELL .

COPY . Dr. Alexander Graham Bell, 1331 Connecticut Avenue, Washington, D.C.

Dubuque, Iowa, Oct. 6, 1908 :— The writer was interested in your article appearing in Aeronautics in reference to the Bleriot accident which in all probability was brought about by the action of gyroscopic force.

We have always contended that the maximum of safety is only secured by the use of two motors revolving in opposite directions and two propellers revolving in opposite directions, as this neutralizes all torque and gyroscopic effects.

As you may not be familar with the details of our revolving motor we are mailing a copy of our aeronautic catalogue under separate cover and enclose herewith blue prints showing a few of the methods of using two such motors to drive various transmission mechanisms.

We call your attention in particular to the fact that our motor weighs only 2.7 pounds per horse-power including the carbureter, oil tank, oiler and timer. We employ no cooling device whatever but believe that we have the only motor in existence that is perfectly and automatically cooled at all times.

Although it would be possible to revolve these motors in a vertical plane, we have never built them to run in that way with the exception of a three cylinder of 3 ½" bore which we are now designing for direction connection to an electric generator, making a very compact portable generating plant.

THE ADAMS COMPANY DUBUQUE IOWA Two motors driving concentric shafts (located above motors) in opposite directions 10

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2 As you are probably aware Mr. Emile Berliner has been experimenting with a couple of our motors for some time and is so well pleased with the results that he wishes us to build a special motor of higher power for him.

We hope that you will find our motor interesting and assure you that we will be pleased to hear from you in regard to same.

(Signed) The Adams Company. Glenn Muffly, Sales Agent.

Bell To Adams Company .

To The Adams Company, Dubuque, Iowa.

Baddeck, N.S., Oct. 29, 1908: — Your note of October 6 has been forwarded to me here, and I am very much interested in your motors, especially in the blue print submitted showing two motors revolving in opposite directi n o ns, operating two concentric propeller shafts also rotating in opposite directions.

I should like to have some details concerning the weight of such an arrangement giving about 40 H.P. in all, and some idea of the price.

(Signed) Alexander Graham Bell.

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Russell Thayer to Bell.

To Prof. A.G. Bell, Baddeck, N.S.

Philadelphia, Pa., Sept. 25, 1908: — I enclose herewith a paper on Dirigible Airships which I think will be interesting to you. I am certain of the fact that the principle that I have discovered, solves the matter of Aerial Navigation, so far as the dirigible is concerned, and I am very anxious to have one of them constructed.

I have worked out all the details, and am ready to build. A dirigible can be built, that can travel all over the United States, at the cost of an ordinary automobile, viz, $4000.00. I want to interest some one to furnish say $5000.00 to build one of these.

Nobody seems to realize it, but this is really a wonderful thing; with your large experience you must see its value to the World.

(Signed) Russell Thayer. P.S. I enclose a bent card. Lay it on your table and first blow on the flat side of the bent part; and then turn it one quarter around, and blow on it, and you will see that it proves my statement. R.S.T.

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Bell to Russell Thayer .

To Russell Thayer, Broad and Arch Sts., Philadelphia, Pa.

Baddeck, N.S., Oct. 21, 1908: — I have been away from home and your note of Sept. 25 has just been brought to my attention.

Allow me to assure you of the very great interest that the members of the Aerial Experiment Association take in your idea of developing and utilizing gyroscopic force to provide, as it were, a lever in space without any fulcrum on the earth so as to utilize wind pressure upon a balloon as a means of propulsion.

While our attention is more particularly directed to the development of heavier-than-air machines so that we cannot assist you directly in developing experimentally your important ideas relating to balloons, we can at all events express sympathy with your work and appreciation of the central thought that guides it.

If you can suggest any means by which this Association could assist you in making known your ideas to persons who would be willing to give you the means to test them we feel that we might thereby be instrumental in opening up a new field of experimental work that might prove of great practical importance.

Why not write to General Allen, Chief Signal Officer of the U S Army, who is now experimenting with dirigible balloons. You are at liberty to say to him that, while we cannot endorse all the points you claim until demonstrated by experiment, we think your ideas are eminently worthy of practical investigation and should be tested.

Your little experiment with the best card is interesting and suggestive.

(Signed) Alexander Graham Bell.

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THAYER DIRIGIBLE AIRSHIP: By Russell Thayer.

An aerial vessel that can be propelled through the atmosphere with the same facility and in the same manner as a ship sailing y u pon the ocean.

This new discovery for the propulsion of dirigible airships, is based on the development and application of gyroscopic forces, in combination with the forces developed by the wind pressure on the sail of the airship.

The following well known law of Mechanics may be taken as the basis of this discovery. It is one of the laws which govern the motions of the celestial bodies, the Sun, the Planets and the other Stars in their revolutions through space.

A body suspended in space and free to move in any direction, if acted upon by two or more extraneous forces, will take up a motion of translation in the line of its least resistance, due to the resultant of the forces acting upon it.

The following law also, relating to a d n dgoverning the movements of rotating bodies, may also be here referred to viz: When a body rotating upon a principal axis, is subjected to a force tending to produce another rotation not parallel to the former, the resultant effect is such displacement of the axis of the original rotation, with respect to its support, as is most favorable to the parallelism of the two rotations, and such displacement is at right angles to the direction of the disturbing force.

I have discovered, that by utilizing the reactive gyroscopic force manifested upon any attempt to change the 15 2 direction of the axis of a rotary body, in combination with the wind pressure upon a balloon floating in the atmosphere and carrying sa d i d body; that the movement of the balloon may be variably determined and controlled by correlation of the force developed by the gyroscope and the force of the air current.

THAYER DIRIGIBLE AIRSHIP .

In other words, my invention provides means, whereby wind pressure tending to diverge a balloon from a predetermined direction of traverse, may be variably opposed by the gyroscopic effect of a rotary body carried by the balloon, under the control of the operator, so that such wind pressure may be utilized to propel the balloon in directions oblique to the wind pressure, as in ordinary marine navigation.

The gyroscopic effect that I refer to, is due to the fact that a rotary body tends to maintain constant its plane of rotation, and consequent direction of its axis of rotation; such effect being increased or diminished in correspondence with the speed of rotation of the body.

It is important to note, however, that to render such reactive effect available, it is necessary to so mount the rotary body, that its axis of rotation, is free to oscillate, to a limited extent, in a direction parallel to the direction of said axis.

It is interesting to here note the various commercial uses to which the gyroscope has been adapted, in order to utilize its curious powers.

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3 To the untrained mind it seems to possess mysterious faculties. It will support itself, for instance, suspended in space, at right angles to a cord, resisting continuously the constant force of gravity, while it is spinning at high speed.

Other interesting phenomena may be demonstrated by its means. The laws of rotating bodies however, are well understood by mathematicians, and while it is quite true that the mathematics of the gyroscope are complicated and obtuse, nevertheless there is no mystery about the matter, and the forces developed by the gyroscope follow the established laws of rotating bodies, which are free to move and rotate at high speed, on what I may term elastic axes.

The peculiar property that the axis of a rotating gyroscope possesses of continuously pointing in a fixed given direction, notwithstanding the motion of translation of the Earth through space, and its independent rotation on its own axis, has been used by the astronomer for the usefull purpose of maintaining the axis of his astronomical telescope constantly trained upon a star, that he may be observing, thus being able to observe it continuously in the field of view, while otherwise, in a few seconds it would pass across the lens.

One of the first uses to which the gyroscope was adapted, after its discovery, was in Marine Navigation; in order to provide an artificial horizon on a moving vessel, in order to make observations. For this purpose the gyroscope is caused to revolve on a vertical axis; this was in use for 17 4 some time, and I believe is still in use in certain navies in the world.

The gyroscope is used very effectually and almost universally in controlling the direction of traverse of the Submarine war torpedo, known as the Whitehead torpedo, that deadly instrument of destruction, now in general use in all the Navies of the World.

In this instance it is placed inside the casing and near the stern of the torpedo, and by an ingenious arrangement operates two small rudders which maintain the direction of traverse of the torpedo on its predetermined course.

This result is effected by utilizing the same force that I use in aerial navigation, but of course, in an entirely different manner.

The Mono-Rail system of Mr. Louis Brennan, uses the forces of the gyroscope to balance the cars on the single rail roadway that is employed in this system.

The well known and costly experiment of Sir Henry Bessemer made by that distinguished and accomplished engineer about 25 years ago, to utilize the principle of the gyroscope to prevent the rolling of ships in a sea-way at Sea, may also be referred to. Sir Henry however failed in the experiment, for the reason that he overlooked one of the essential laws of the revolution of the gyroscope, and it is said that he expended about a million dollars on this work.

Dr. Otto Schlick, a German engineer of Berlin e , , first demonstrated the practical utility of the gyroscope, in preventing a ship from rolling in a sea-way.

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5 In July 1906, with the sea so rough that the ship (the Sea-Bar) rolled through an arc of thirty degrees, when the gyroscope was not in revolution, the arc of rolling was reduced to one degree, when the gyroscope was set spinning and its secondary bearings released.

In other words it practically abolished the rolling motion of the Craft, causing its deck to remain substantially level, when the ship as a whole heaved up and down with the waves.

The Dirigible Balloon as now universally used, particularly in the various Armies of the World, is propelled through space by means of fans or propellers, which as may be readily understood are very ineffectual in propulsion.

There is an enormous waste of power, due to the slip of the fan blades etc., and in a wind of any considerable velocity the structure is quite helpless.

<u>The problem of the navigation of the air</u> , after the inventions of the balloons <u>has always been to devise some point of support upon which we can take hold, so to speak, in order to utilize the propelling effect of wind pressure</u> .

This of course (until my discovery) it has been impossible to do, as the entire structure is drifting in a fluid, in which the structure itself is immersed.

The use of the gyroscopic forces that I have described, solves the problem, and gives us a line of support against which we may apply and utilize wind force to propel our craft.

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6 <u>Developing and utilizing the forces of the gyroscope in the manner that I have described, actually provides a lever in space without any fulcrum on the earth, and the results following from this fact are evident and far reaching</u> .

By the proper use of sail and rudder and gyroscopic forces, our dirigible airship may be propelled in any direction except against or close to the wind, when the wind is blowing at variable speeds, and, as we are navigating an ocean some five miles in depth, without rocks or other obstructions, the possibilities of the dirigible airship, particularly for war purposes are very great.

(Signed) Russell Thayer. Am. Soc. C.E.

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<u>VAUGHN</u> <u>TO</u> <u>BELL</u> .

<u>COPY.</u> U.S.S. Yorktown, 3rd Rate, Valdez, Alaska, Sept. 15, 1908. Dr. Alexander Graham Bell, Hammondsport, N.Y. Dear Sir:

Being an enthusiastic admirer and student of Aerial Navigation, and more especially of the “Aeroplane System” of navigating the air, I take the liberty of presenting to you some of my ideas in the construction of aeroplanes with hopes that some of them will be of value to you and help to solve the universal problem of soaring the air.

While I have never seen an aeroplane at close quarters, I have made a careful study of the photographs and articles about airships, which are published from time to time in various magazines. In all of the machines, except the ones you and the Wrights are constructing, I find one great fault, and that is not having full control of the wings, and not having them so arranged that they can be made to meet the different currents of air and ensure stability under any circumstances. Another fault is: I may be wrong, most of the machines have a tremendous vertical rudder for steering the ship. Take Dumont's machine, Delagrange's machine, Farman's machine and others, and you will find that they all have a large vertical rudder, with me it seems as though it would be impossible for them to steer across a strong current of 21 2 air for any distance without heading into it. Take Farman's machine with its big box kite tail, nearly as large as the wings themselves. Do you think that it is hardly possible for him to steer across a stiff wind with ease? Take for example one of the oldest inventions, the windmill, it has a very large vertical rudder which keeps the mill headed toward the wind in order to run. Also suppose that a ship, say 100 feet long, had a rudder attached to it 100 feet from its stern, do you think this ship could steer across a strong current of water, and not head up stream instead. I believe it a good idea not to have a vertical rudder if you could possibly do away with it. If the machine tends to zig-zag a very small vertical rudder could be placed astern to prevent this until something else is invented to stop the zig-zag motion. The rudder could be so arranged that if the machine does not go straight the rudder could be set at an angle to correct this error in construction. For making short turns I think my idea about the window shade vertical rudder (see description of drawings) attached to each end of the wings a good idea. When one rudder is opened it causes a resistance at that end which swings the machine around like a turn-table. For long turns the flexible steel wing tips can be used. Incline the planes in the direction you want to go, and if I am not mistaken, the machine will make the turn. Take for example a bird, it has no vertical rudder, all it does is incline its body in the direction it wants to go and he 22 3 makes the turn. Take an expert bicycle rider, he can ride in any direction without holding the bars, by simply inclining his body in direction he wishes to go. Why won't an aeroplane do the same thing if handled right.

Another of my ideas, not in the drawings, is about the horizontal rudders astern. I believe the horizontal rudder should be used only in preventing the machine from pitching, correcting the fore and aft inclination, and making a landing, and NOT to be used in raising or lowering the machine from or to the ground. The horizontal rudder in front is for lowering or raising the machine and the horizontal rudder aft act a s as a kind of tail to prevent the machine from pitching. When the machine alights the rudder aft is inclined in such a way that the tail wheel touches the ground first. In watching birds light in the water or on ground, I find that the tail is always a great deal lower than the wings, and by alighting in this position the tail and wings form a kind of air-brake to stop their forward motion.

I believe that in the future, if my ideas about flexible wing tips etc. prove successful that a machine's stability in the air will be entirely governed by the gyroscope, or by a weight suspended and attached to the wing wires in such a way that if the machine tends to capsize, the weight or gyroscope will curve the wings to such an extent that the machine will right itself again. Why not use the operator and passengers in place of the weight . Have the seats so arranged that if a person sits on them he will be the same as a suspended weight. All of the minor details such as arrangement 23 4 of the machinery to do this work can very easily be done. Most machines rise in the air, but very few stay on account of not having arrangements made to overcome the different currents of air.

In order to have a light strong machine, I believe that all of the joints should be wrapped in different ways with strong cord, and covered with a thick coating of good glue and then painted. This is where seamanship comes in. If the frame is steel or iron wrap the joints with wire. I believe the canvas covering for the planes should be put on the bottom of both upper and lower frames, and not on top, (see drawing), as it offers less resistance and makes the frame stronger.

Doctor, if in writing this letter and submitting to you my plans and ideas, I seem to criticise your most highly appreciated and valued work, I wish to assure you that it is purely unintentional. I trust that it will not be taken as a criticism, but as ideas of a person who knows very little about aerial navigation, and from one who is anxious to become a student and to learn, with hopes that his ideas are not in vain.

Whenever the opportunity offers itself, and I am in a position to experiment with that line of work, I hope that some day I will be a close competitor for some of the big prizes which are now offered to the public in general.

Trusting that these ideas will be of some value to 24 5 you in your experimental work, I wish to remain

(Signed) Sidney P. Vaughn, United States Navy. P. S. If you write please address me, U.S.S. Yorktown, care Post Master, San Francisco, California, and your letter will reach me O.K. I have other ideas which may prove of help to you. P.P.S. Since writing this letter I have received the Scientific American, dated August 22. On page 124 they give photographs of the latest foreign aeroplanes. I think Gastambide is still on the wrong track. Capt. Ferber's machine is a good improvement, having a very small vertical rudder, but I don't think much of the rest of his design. Zen's aeroplane, as they say, is a great improvement over the rest. He has no vertical rudder, but his after horizontal rudder is too large. I don't like his idea about using the front rudder in rising and turning. He should use his wing tips. Am I right?

S.P.V.

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Bell to Vaughn .

To Mr. Sydney P. Vaughn, U.S.S. Yorktown, c/o of Postmaster, San Francisco, Cal.

Baddeck, N.S., Oct. 29, 1908:— There has been some delay in the delivery of your registered letter of September 15, which was forwarded from Hammondsport, N.Y. and only reached me here October 10.

All of the ideas contained in your letter seem to me to be eminently worthy of serious consideration.

It may be interesting to you to know that one or two of them had already been discussed by members of the Association and experiments instituted long before we heard from you. I allude especially to your proposition of wing tip controls placed at each side between the aeroplanes, and the idea of using the aviator himself on a swinging seat to control automatically the equilibrium of the machine, also the idea of using the wing tip controls to steer the machine in place of a vertical rudder.

This does not, of course, in any way detract from your merit in making the suggestions, nor from your generosity in communicating them to us.

(Signed) Alexander Graham Bell. Chairman A.E.A.

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DESCRIPTION OF DRAWINGS.

These drawings are not accurate in proportions and construction, and are made merely to point out new and perhaps useful ideas in the construction of aeroplanes.

Fig. 1–2 are partial drawings of aeroplanes pointing out positions of ideas which can be attached to any style of frames.

Like letters refer to like parts.

Fig. 1 is a simple drawing of an aeroplane frame showing position and construction of horizontal rudders between upper and lower planes. They also can be called a third plane which is moveable between the upper and lower planes. Also shows method of placing the canvas on the under side of plane framework.

Letters A-A 1 point out moveable horizontal rudders or third planes to which are attached wires working through blocks D to spools C-C 1 -C 2 on shafts B-B 1 . The rear end of these rudders swing clear of all framework and are supported only by the rear wires which work on rear shaft. The front end of planes are so arranged that they can slide up or down between the front stanchions and rod G (attached to stanchion) which forms a kind of slide. The wire on spools C and C 1 is wrapped differently. On spools C it is wrapped from you and on spools C 1 it is wrapped toward you. This permits the rudders being moved to meet different currents of air. When the rear end of plane A is low the rear end of plane A 1 is high and vice versa. The wires working the front part of planes are all wrapped one way on the spools C 2 on shaft B 1 . When the shaft B 1 is turned 27 2 it causes the front end of horizontal rudders A-A 1 to be raised or lowered. This causes the machine to rise or fall at the will of the operator. The opposite motion on the back part of the rudders is supposed to keep the ship on an even keel. Both shafts B-B 1 are worked by wires run n ing from spools C 3 to steering wheels handy to the operator. These horizontal rudders do away with the horizontal rudder which is used out in front of the machine and at the same time it keeps the machine from tipping or turning over. It can be used in turning curves and helps to do away with a large vertical rudder. Note particularly the way the wire is wrapped on rear spools.

Letter E shows a form of slat that supports the canvas. These slats are placed on under side (not on top) of both upper and lower parts of frame as shown in drawing. The canvas is put on the under side (not top side) of these slats. This makes the machine stronger and offers less resistance to the wind.

Fig. 2 is a drawing showing method of having flexible wing tips A-A and A 1 -A 1 with wires running to the steering wheel.

Letters B are flexible steel slats (tapering) attached to plane slats K. At the end of these steel slats are tapering steel rods or slats B 1 attached so that if the corner is pulled down it will take on a kind of spiral shape. The wires C-C 1 run from opposite corners, upper left hand corner and lower right hand corner, and meet on a steering wheel in such a way that if the wheel is turned it will cause the upper left 28 3 hand and lower right hand corner of flexible tips to form a spiral toward the opposite corners. The wires D-D 1 are worked the same way. If worked right these flexible wing tips will keep the machine on an even keel and it will be almost impossible to capsize it. In addition to this it does away with the vertical rudder in the rear. The flexible wing tips will turn the machine in any direction if worked right. To raise and lower the machine a flexible horizontal rudder attached to the upper and lower planes in front, as shown by dotted lines H, worked by wires should do the work of the horizontal rudder which is on a heavy frame in front on most machines. It is a good idea to use flexible wing tips on every part of the planes where they can be put to use. For making short quick turns with the machine, have two (one at each end) vertical rudders that opens and close like a window shade, connected to a steering wheel by wires G, as shown by F at right hand corner of Fig. 2. If the operator wishes to make a quick turn he opens up the shade or rudder, which causes a great resistance at the end of plane, and the machine will spin around like a turn-table. By having these rudders on each end the operator can turn quickly in any direction. To keep the machine from zig-zaging a very small vertical rudder (stationary) could be hung on behind with a small horizontal rudder to act as a kind of tail. S.P.V.

AEROPLANES -IMPROVEMENTS ON- Sept. 12 -1908 Fig 1.

Fig 2.

30

Robertson to Bell .

To Dr. A.G. Bell, Washington, D.C.

Mt. Vernon, Indiana, Sept. 20, 1908 :— I beg to submit for your consideration some crude ideas of mine on aerial craft. I do this for the benefit of the cause, and not with the hope of realizing anything in a financial way.

Formerly, while in the Government service at Washington, I used to occasionally consult with the Smithsonian Officials on this subject, but was never in sympathy with Prof.

Langley's aeroplane ideas; and since the deplorable accident at Fort Meyer lately, I am more thoroughly convinced y t hat of itself the aeroplane will never be a success, for war purposes. Nor am I in sympathy with Count Zeppelin's ideas of such a large dirigible balloon. I believe the successfull aerial machine of the future will be a " composite " embodying the three types, aeroplane, dirigible and helicopter, somewhat on the lines of the enclosed rough drawing.

I do not go into the minute details of construction in this, but you can get a good general idea of the design and will, I think, readily understand them. You will notice my idea is to have two small cigar-shaped balloons, each made in three separate sections, laced together and the two balloons harnessed together by a bamboo and aluminum frame like this 31 2 with two propellers for propulsion, hung on a center line between ; and one lifting propeller (reversible) and several aeroplanes, as shown by blue lines: Also a small steering propeller fixed on a universal joint attached to the engine shaft.

The balloons need not of themselves be large enough to raise the machine, but would assist the horizontal propeller, and give stability to the whole thing, and prevent a rapid descent in case the motor should stop.

The engine on the lower platform would help to balance the balloon, and the two vertical propellers placed on a center line between would have a straight forward pull on the nose of the balloons which is not possible with the single bag dirigible having the engine and propellers hung so far below.

After the machine had been raised to the desired altitude, the lifting propeller could be disconnected and the two pushing propellers put in action, and these with aeroplanes and small gas bags would hold the whole machine up.

One advantage of this construction would be that in case it should be compelled to descend on the water, it would float with the engines above the water line.

I have as yet made no further attempt towards developing this idea, than the construction of a small model about 32

END VIEW

Side Elevation

33

Plan

34 3 24 × 36 inches.

I should be pleased to have you look into this design and perfect it, and give it a trial, if you think it worthy of consideration; and should you desire further details, as they occur to me, I would be pleased to give them in so far as I can.

As an Ex Navy Offic r e r, I should be pleased to see the United States lead the world in matters of this class, as well as in battleships.

(Signed) Geo. W. Robertson.

35

Bell to Robertson .

To Mr. Geo. W. Robertson, Mt. Vernon, Indiana.

Baddeck, N.S., Oct. 7, 1908: — Allow me to thank you for your note of Sept. 20 with accompanying illustrations of your suggested aerial craft.

The Aerial Experiment Association, of which I am Chairman, is as you probably know, an “Experiment Association” pure and simple carrying on experiments, not for gain, but to promote the art of aviation in America.

It would give me great pleasure to submit your ideas relating to an aerial craft to the members of this Association for discussion and consideration, if you so desire, but we cannot, of course, receive or consider communications of a confidential nature or be interested financially in them Any printed material or manuscripts that are not confidential we are always glad to receive and discuss.

I presume that your note to me and the illustration accompanying it are not intended to be confidential, and I will therefore communicate copies to the other members of the Association for their consideration unless I hear from you to the contrary. Although our Association is devoted mainly to experiments relating to heavier-than-air machines we are, of course, interested in all plans for aerial flight, and I have no doubt that the other members of the Association will be as much interested in your plans as I myself.

(Signed) Alexander Graham Bell.

36

Robertson to Bell .

To Dr. A.G. Bell, Baddeck, N.S.

Mt. Vernon, Indiana, Oct. 18, 1908 :— Your favor of 7th inst. in answer to my letter of Sept. 20 has been received. My suggestions on aerial craft were not for gain, but to promote the art of aviation in America; and it would please me to have you submit my plans to the members of the Association for discussion and consideration, as my letter was not intended to be confidential. I have never tried to take out any patents on this idea, and do not intend to.

I should be pleased to give you any further suggestions on the subject, as they may occur to me should you desire. The little model I have constructed (about 24“ × 36“) would show up the idea much better than the drawings, and I will ship it to you by express if you wish.

The point I stated in my letter of Sept. 20, that the gas bags need not necessarily be large enough to lift the machine depending on the horizontal propeller for a part of the lift, was with the idea of giving it greater speed when going forward and using the aeroplanes. In cases where speed was not desirable additional sections of balloons could be inserted, so it would have more buoyancy and the bamboo harness frame lengthened. I am of the opinion that aeroplanes may be so perfected in time that they could probably be used as "Scouts" in war, but I think for real military service the aerial craft must be able to move slowly and steadily at times; or hover over any desired spot for a while and then move back to its headquarters rapidly.

(Signed) Geo. W. Robertson.

BULLETINS OF THE Aerial Experiment Association

Bulletin No. XVIII Issued MONDAY, NOV. 9, 1908

ASSOCIATION COPY.

BEINN BHREAGH, NEAR BADDECK, NOVA SCOTIA

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Bulletins of the Aerial Experiment Association .

BULLETIN NO.XVIII ISSUED MONDAY NOV. 9, 1908.

Beinn Bhreagh, Near Baddeck, Nova Scotia .

TABLE OF CONTENTS.

Farman, Bleriot, Germany, Clement-Bayard, Dr. J.F. Fielding, C.W. Williams, and Frank J. Heinfelt.

ILLUSTRATIONS .

1

SWINGING SEAT.

Beinn Bhreagh, Oct. 26, 1908:— The object of the double support for a swinging seat (Bulletin XIV p. 14; Bulletin XVI p. 49) was to secure the point that the seat should remain horizontal however it might be moved by the aviator. As soon as a model was constructed it became obvious that in its automatic action the seat would not remain horizontal. For example:— Should the machine make a dive, though the seat would swing forwards it would be tilted down in front thus tending to eject the man. This action has been remedied by adopting a single support (see photograph in this Bulletin).

It would be very desirable to secure some automatic action over the controls and this certainly can be accomplished by utilizing the weight of the operator upon a moveable seat without interfering with voluntary control by the aviator himself. In the plan contemplated the main work of longitudinal control would be accomplished automatically by the operator's weight leaving the finer adjustments to be done voluntarily.

There is one grave disadvantage, however, touching the very principle of a swinging seat. It is obviously impracticable to have the axis of the sing at the center of gravity of the machine. The motion of the sing therefore will occasion a displacement of the center of gravity and unfortunately in the wrong direction for safety. If the machine tips down the seat swings forward, thus displacing the center of gravity forwards instead of backwards so that 2 2 the displacement tends to help the dive and make it steeper. It is only through its automatic control over the vertical steering surfaces that the swinging seat has its advantage.

I am inclined to think that it would be better to hold fast to the important principle embodied in the Hammondsport machines and substitute the instinctive motions of the aviator for automatic action by gravity.

If the machine should make a dive natural instinct tends to make a man lean back. This displaces the center of gravity in the right direction and in the Hammondsport machines the man naturally leans back in operating his front control to correct the dive. In correcting the climbing tendency the man leans forward. In correcting a tip downwards to the left the man leans to the right, or high side; and vice versa where the tip is on the other side.

The co-operation of instinctive movements with the operation of the various controls seems to me too important a point to be lightly given up. There is far less liability to move the wrong lever as is sometimes done even by the Wright Brothers themselves. I am therefore looking with less favor upon automatic action through a swinging seat and with more favor upon instinctive movements combined with the operation of the steering devices. A.G.B.

3

DROME NO. 4 .

Beinn Bhreagh, Oct. 31, 1908: — Drome No. 4, McCurdy's “Silver-Dart”, is now completed and the new engine installed. The machine has been taken to the tent at the Race Track and a telegram is expected every moment announcing its first flight. Photographs of the Silver-Dart appear in this Bulletin. A.G.B.

4

DROME NO. 5 .

Beinn Bhreagh, November 4, 1908 :— Drome No. 5 is now completed with the exception of the body section and the steering appendages. Photographs in this Bulletin show its present condition.

The body section is now being started and will be substantially similar to the center part of the Cygnet with a manhole of the same shape and size, but made in a different manner which will be described in a subsequent Bulletin.

I have now decided that a front control will not be used upon Drome No. 5 because it is to be started as a kite and the presence of a front control would be likely to produce dangerous oscillations in the structure while flying as a kite. If we had only to deal with the wind of advance the front control would, of course, be as advantageous as in the case of our other aerodromes. If we don't have a horizontal rudder in front we have to consider placing it in the rear behind the propellers. It is extremely doubtful how far it is advisable to place any rudders in the draft of the propeller and a difficulty presents itself in sustaining the rudder by supports so far removed from the propeller blades as to obviate all chances of a Wright disaster.

This leads me to consider the advisability of using two horizontal rudders behind the main structure, one at either side of the wing piece arranged normally with their 5 2 surfaces parallel to the line of advance.

In our Hammondsport aerodromes we have three different kinds of steering to perform at the same time.

(1) Vertical steering up or down.

(2) Horizont? steering right or left.

(3) Balancing steering by our wing tips to remedy tipping action.

Now the thought occurs will not these two horizontal rudders alone serve all the purposes of the three kinds of steering, required and with only two levers to operate them one for each rudder.

(1) For vertical steering both rudders could be moved simultaneously up or down.

(2) For horizontal steering, one rudder alone moved, or both in different degrees so that the introduced resistance to advance shall be different at the two sides of the structure.

(3) Balancing steering, the two rudders moved equally in opposite directions so that the righting action will be produced while the introduced resistances to advance would be the same at either side so that no turning movement around a vertical axis would be caused.

My mind is gradually inclining to the idea of two horizontal rudders at the rear to take the place of all the different methods of control employed on the Hammondsport machines. The great objection being that they would be out of sight of the aviator.

6

3 Of course we could consider placing them in front of the structure at either side thus placing them within sight of the aviator with the advantage of operating in fresh air undisturbed by the presence of winged cells in front of them. In this arrangement they would constitute, in effect, two front controls instead of one. I am a little doubtful, however, of the practicability of this arrangement in a structure intended to be flown as a kite but will give it further consideration. A.G.B.

7

DROME NO. 6.

Beinn Bhreagh, Nov. 5, 1908: — Mr. Baldwin has made another step in advance towards the realization of aerodrome No. 6.

On Oct. 29 the Dhonnas Beag carrying Mr. Baldwin and the Curtiss No. 2 engine rose completely out of the water on her hydroplanes when propelled by her own power instead of being towed by the “Skidoo”.

Thus his primary object has been realized but he has been unable as yet to test the speed that the machine will attain under the new conditions, for the following reasons:—

(1) When the boat rises, the rudder being lifted out of water, no longer serves to steer the boat and power has to be shut off to prevent ramming the bank of the harbor. This defect has been remedied by the construction of an aerial rudder superposed upon the water rudder and working on the same axis.

On Nov. 3 an attempt was made to speed up on the hydroplanes. The rudders worked perfectly and there was no difficulty in steering the boat, both in and out of the water.

(2) When the boat rises the outrigger floats are lifted completely out of water and the whole arrangement, though supported upon its hydroplanes is in a state of unstable equilibrium. The center of gravity being considerably above the base of support, the machine tips

over to one side or the other and is only prevented from turning completely over by the buoyancy of the outrigger floats.

This difficulty also presented itself during the previous towing experiments and was partially met by the 8 2 employment of flexible hydroplanes of the hayrake pattern placed close to the outrigger floats so that when the floats were lifted out of water a portion of the flexible hydroplanes remained immersed. The result, however, was not entirely satisfactory probably because the flexible rods were not stiff enough for the purpose but in the towing experiments, by leaning over to the high side the balance could be restored.

The weight of the engine combined with the man, produces too great an upsetting tendency to be remedied by leaning over to the high side. Mr. Baldwin proposes to try flexible rods again (they have not so far been used with the engine and propeller on board) but they will have to be made much stiffer than formerly to resist the action

He also proposes when he comes to build a new structure to place the man and engine inside the boat instead of above it, but this cannot be done with the present arrangement.

A new arrangement of hydro-surfaces (hydro-curves, not hydroplanes) is now being made, and we think that the stability of the boat, when out of water, will be so much improved that it may be possible to test the acquired speed, Description of these hydro-surfaces will be given in another Bulletin.

A model has been made of the tetrahedral structure of Oionos form which is to constitute the aerial part of drome No. 6 which is now ready to be tested as a kite. This will be described in a subsequent Bulletin. A.G.B.

9

TELEGRAMS AND LETTERS FROM MEMBERS.

Bell to McCurdy .

To J.A.D. McCurdy, Hammondsport, N.Y.

Baddeck, N.S., Oct. 24, 1908 :—I am sending you paper on the causes of the accident to Orville Wright's machine. Want you to read it before trying Silver-Dart.

(Signed) Graham Bell.

McCurdy to Bell .

To A.G. Bell, Baddeck, N.S.

Hammondsport, N.Y., Oct. 28, 1908 :—Engine installed in Silver-Dart. Will balance her up to-morrow and hold trial Friday to Saturday weather permitting. Will notify Secretary of War.

(Signed) J.A.D. McCurdy.

Bell to Curtiss .

To G.H. Curtiss, Hammondsport, N.Y.

Baddeck, N.S., Oct. 30, 1908 :— Hydroplane boat lifted out of water yesterday by her own power carrying Baldwin.

(Signed) Graham Bell.

Curtiss to Bell .

To A.G. Bell, Baddeck, N.S.

Hammondsport, N.Y., Oct. 31, 1908 :— Have wired Aeronautical Society as follows:— “Morris Park impossible. No flights here yet. Very sorry indeed.

(Signed) G.H. Curtiss

Curtiss to Bell .

Hammondsport, N.Y., Oct. 31, 1908 :— Silver-Dart engine installed ready to fly. Pull 300 lbs. Congratulations, good work with hydroplanes.

(Signed) G.H. Curtiss.

10

Curtiss to Bell.

To A. G. Bell, Baddeck, N.S.

Hammondsport, N. Y., Oct. 22, 1908: — We have your letter and in response have mailed seven each of several of the recent pictures taken here, gotten up as best we could, for the Bulletin. We have mailed prints of these before but had left it to you as Editor to select what you wanted.

John has sent the “Silver-Dart” drawings to New York for reproduction in Bulletin size, and promises copy in time to print with them.

We also have your message in reference to the second trial for the Cup. We have wired Mr. Manley that we would not enter until we had made try-outs here. We assume that if we can fly the 25 kilometers here the first of the week that we could also do it in New York a week from Tuesday, November 3, and that if we were reasonably sure of winning the second “leg” of this three-legged affair and if, as they promised, they pay for the expense of bringing the machine there to make the trials, that you would not object to its being done.

I am going to New York to-night to see Manley, look over Morris Park and the course so as to be sure of our ground there.

The new motor will be run under its own power for the first time this afternoon and thoroughly tested out tomorrow. This will give us Saturday to get it installed in the "Silver-Dart", by which time I will have returned from 11 2 New York and make our first trial not later than Monday, weather permitting. We will wire you to this effect as soon as we are sure of everything on the motor.

(S ? i gned) G.H. Curtiss.

12

McCurdy to Bell.

To A. G. Bell, Baddeck, N.S.

Hammondsport, N.Y., Oct. 24, 1908: — I am enclosing for you a copy of the paper Mr. Chanute was kind enough to send me. I had made two copies, one for our records which I will keep in a portfolio, and the one I am sending you for your information and perhaps for incorporation into one Bulletin if you see fit. It is very interesting especially as it shows us how Mr. Chanute computed head resistance in his multiple winged glider.

I have employed this method and carefully measured all the struts, wires, tubing and bamboo used for structural purposes on the Silver-Dart and computed the head resistance. I will make a full report of this in the article I am trying to write on the differences between the Silver-Dart and June Bug.

The water-cooled motor has been assembled and was run under its own power yesterday morning (Friday Oct. 23). It was only run for about three minutes and then immediately taken down for inspection and adjustment of its parts. This is the usual custom. We hope to have it complete down at the shed to-morrow (Sunday) afternoon when we will try out our different propellers to ascertain the various pulls.

We have designed a propeller somewhat along the lines adopted by the Wright Brothers, copying in general lines that Albatross' wing represented in the Aeronautical Annual to which I referred in my last note to you. It is 8 ft in 13 2 diameter, 17° pitch at the tip and has its maximum width of blade one third of the distance from the tip to the axis.

It was finished to-day and will be tried out to-morrow. Somehow it looks good to me and we can compare its pull with another propeller of the same general dimension but lacking the wedge shaped cutting edge, it does seem as although the cutting edge ought to be designed so as to shed the air meeting it rather than have to push this mass of air right along before it.

We are getting so impatient to try out the Silver-Dart. Thursday afternoon while we were up at the tent, Mr. H. Champlin came along with his big dog weighing about 40 lbs. and while we stood round the machine talking the do ? g for some reason or other jumped on to the lower right wing and of course went plump through making an awful hole. Ingraham and I however repaired it to-day so it is as good as new.

Just received your telegram about papers you are sending concerning causes of accident to Wright aeroplane. We expect if all goes well to have the first preliminary trials on Monday. I do so wish that you and Mrs. Bell could be here.

Mr. Curtiss went to New York yesterday to attend the Vanderbilt race, but will be home Sunday morning. By the way did you receive a package of photographs I sent you by express about a month ago. It was a complete set of mounted prints representing our work here up to the end of experiments with the June Bug.

14

3 Could you also please tell me if that formula for computing the lift of an aeroplane (flat surface) is P‘ Sin × Cos ×/1 plus or minus Sin × I don't remember and can't find it in any of the reference books I have here. Casey may know.

Maj. Squier will write his part of Tom's biography, and will have officer here for trials.

(Signed) J.A.D. McCurdy.

15

Curtiss to Bell .

To A.G. Bell, Baddeck, N.S.

Hammondsport, N.Y., Oct. 26, 1908: — I enclose a couple of clippings. The one referring to the Wright's control is quite significant:—

“Messrs. Wilbur and Orville Wright discourage us — what chance have we to fly in their aeroplane if they, its designers, aeronauts of years standing, pull the wrong lever so often”.

I have just returned from New York. ? T he Aero Society's grounds are all that could be expected or desired as to size. There are a number of fences, however, which would be objectionable in case of forced landing, and if we should go there I believe we should insist that they be removed. It seems doubtful if we can get ready in time. To-day is Monday and we still have the engine in the shops. It has been tested, however, and exceededour expectations. This afternoon we will try the different propellers.

Under separate cover I am sending seven pictures for the Bulletin, together with descriptive copy; also another little “anecdote” on flight over water.

John and I just had a fierce argument over the propellers used by the Wrights. You remember the sketch I sent after first seeing the machine. Later they changed to straight propellers, which John saw; therefore he insisted that they used straight propellers, while I saw them fly with the curved ones. Before coming to blows we decided that they had used both.

(Signed) G. H. Curtiss.

16

AQUATIC FLIGHT: By G. H. Curtiss.

A flying machine to start and light on the water is needed as much as one for use on land. Experiments along this line, therefore, are in order and present greater possibilities in pioneering than land flights with which so much has already been accomplished. The experiments at Beinn Bhreagh demonstrate the possibilities of starting with a hydroplane.

The question arises if the hydroplane is necessary. Why not lift out of the water by the use of the aeroplanes? With a push of 250 pounds a speed of 10 miles an hour should easily be attained without any lift from the planes. At this speed, however, considerable lift would surely be acquired, which would decrease the resistance in the water and increase the speed so that with the speed increased and the resistance decreased the lift of the planes should soon equal the weight of the machine, and aerial flight begin.

The boats to support the aerodrome on the water could be built with flat bottoms at a proper shape to present the minimum resistance both in the water and in the air. The whole outfit would not be heavier than the running gear for land, and could be built strong enough to withstand the shock of landing.

Following up this idea, which was suggested by Mr. McCurdy, we ? h ave utilized the short time we have been obliged to wait for the new motor in rigging up two light boats and placing them under the old June Bug, so that when the opportunity arises we can see if our theory is corre t c t.

17

2 The new water-cooled engine for the Silver-Dart can be used and the experiment made with a very small expenditure of time or money. Complete photographic records of the structure are being made. G.H.C.

RE PROPELLERS: By G. H. Curtiss.

The four large propellers shown in the illustration are for the Silver-Dart. 1,4 and 5 are very similar, while No.3 is the new design by Mr. McCurdy. Propeller NO. 2 shows the comparative size of that used on the June Bug and the ones for the "Dart".

In the first trials these propellers will be geared 15 to 11, that is, 15 revolutions of the engine to 11 of the propeller.

No. 1—8 foot diameter, 16° at the tip; greatest width 9"; weight with clamps 8 ¼ lbs.

No. 2—June Bug propeller with which last flights were made.

No. 3—8 foot diameter, 18° at the tip; greatest width 9 ¼"; width at tip 6"; weight 8 ¼ lbs.

No. 4—Same as No. 1 except ½ lbs heavier.

No. 5—Duplicate of No. 1.

G.H.C.

18 141830-T

Vanadium Steel hollow shaft for 50 H. 8 cylinder motor. Weight 22 pounds. Tensile strength 250,000 pounds. Oct. 21.

1 2 3 4 5 Oct. 22. Oct. 22

19 141830-T

Sept. 17. "June Bug" engine in "Silver Dart."

Sept. 18. “Silver Dart” completed. Ready for new engine

20 141830-T

Oct. 12, “June Bug” and “Silver Dart,” First pictures of more than one flying machine taken in America.

21 147830-T

22

23 24

1908 OCT 17

04. Taken 1808 Oct 13th

25

BALDWIN'S EXPERIMENTS WITH HYDROPLANES OCT. 23, 1908.

Beinn Bhreagh, Oct. 23, 1908 :— Throughout the following experiments the same outfit as shown in Bulletin XVI p.33 was used with the addition of a set of angular hydroplanes amidship shown in photograph in this Bulletin. In these experiments the Dhonnas Beag was towed by the “Skidoo”.

Exp. 1. Load. Efficiency 8.02 Bedwin 135 Pull 40 lbs. Baldwin 165 100 m in 29 sec. Boat 135 Total 435

Remarks:— Boat would hardly clear herself.

Exp. 2. Load Efficiency 6.25 Bedwin 135 Pull 60 lbs. Ross 115 100 m in 30 sec. Boat 135 Total 385

Remarks: Boat came clear out of water this time.

Exp. 3. Load Efficiency 6.21 Bedwin 135 Pull 70 lbs. Baldwin 165 100 m in 30 sec. Boat 135 total 435

Remarks:— Boat lifted out of water.

Exp. 4. Load. Efficiency 6.75 MacDonald 170 Pull 65 lbs. McKillop 135 100 m in 29 sec. Boat 135 total 440

Remarks:— Boat lifted out of water

26

27

28 2 Exp. 5. Load. Bedwin 135 Efficiency 6.86 Baldwin 165 Pull 115 lbs. McKillop 135 100 m in 36 sec. Boat 135 Total 570

Remarks:— Boat did not stay out of water long enough to ascertain pull at the time. G.H.B.

(approved by F.W.B.).

Beinn Bhreagh Oct. 27, 1908:— Six experiments were tried to-day with the Dhonnas Beag but the results under the same conditions varied so greatly that it is to be believed that something must be wrong with the spring balance. In the last experiment the pull varied from 30 lbs going down the course to 60 lbs coming back. As near as can be judged the conditions in both cases were just the same. The conclusion is that the spring balance is wrong. Hence these experiments are not noted. G.H.B.

29

BALDWIN'S EXPERIMENTS WITH HYDROPLANES OCT. 28, 1908.

Beinn Bhreagh, Oct. 28, 1908 :—Throughout these experiments a new spring balance was tried out. Two new sets of iron hydroplanes were used (see illustration in this Bulletin).

Exp. 1. Load. Efficiency 10.96 Rudderham 154 Pull 25 lbs. Boat 140 100 m in 35 sec. Total 294 lbs.

Remarks:— Boat came clear of water.

(Afternoon)

Exp. 2. Load. Efficiency 12.9 Dr. Bell 226 Pull 30 lbs Boat 161 Total 387 lbs

Remarks:— Boat came clear of water.

Exp. 3. Load. Efficiency 12.16 Mrs. Baldwin 143 Pull 25 lbs. Boat 161 Total 304 lbs

Remarks:— Boat came clear of water.

The afternoon experiments were marked by the carrying of two distinguished passengers. In experiment 2 Dr. Bell, and in experiment 3 Mrs. Baldwin. A morris chair was constructed on Dhonnas Beag to ensure comfort for the passengers. So far as we know Mrs. Baldwin has the honor of being the first woman to be carried out of the water on hydroplanes.

30

139538-A by S McDonald

31

3 Mr. Baldwin is inclined to be encouraged with the results of the above experiments. He believes that it will be possible to get the Dhonnas Beag clear of the water under her own engine power, and for this end his energies will be spent during the next few days. G.H.B.

Beinn Bhreagh, Oct. 29, 1908 :— To-day the Dhonnas Beag, with Mr. Baldwin on board, rose entirely out of the water, supported upon her hydroplanes and propelled by her own motive power instead of being towed.

The following note gives an account of the experiments in the words of Mr. Baldwin:—

Beinn Bhreagh, Oct. 29, 1908 :— We tried the Dhonnas Beag with her own motor power and the new hydroplanes. The thrust of the propellers was 95 lbs and the angle of incidence of the planes was 5°. The boat weighed 154 lbs, power plant 210 lbs and man 170 lbs; total 534.

The first arrangement of hydroplanes was not successful. The high line of thrust requiring the after plane to be moved to a position just about under the center of gravity while the forward plane had to be moved to within two feet of the bow. With this the machine trimmed well and both bow and stern lifted clear of the water. The after hydroplane, however, gave way under the strain and was very badly buckled, partly due to a guy wire around her nose cutting through a copper sheeting andsinking about an inch into the wood. The after set of planes was so badly twisted that while it was being repaired we decided to try one of the old sets with a wooden plane below. As the surface was smaller we put it a little farther aft but again found the boat to lift by the stern leaving the bow in the water so shifted the after plane ahead again to a point about a foot behind the center of gravity, and on trial the boat came clear of the water but once more smashed the after hydroplane. In each case the attempts to get some idea of speed was spoiled by the breakdown before the boat had acquired her true speed. F.W.B.

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In the above note Mr. Baldwin says little about the point that impressed the onlookers most, namely that the Dhonnas Beag for the first time in her history lifted herself clear of the water with man and engine on board and propelled entirely by an aerial propeller under her own motive power.

To-day's experiments therefore form the culminating point of a series of experiments which have largely been discouraging. After weeks of endeavor without success to have the Dhonnas Beag do what she did to-day Mr. Baldwin reduced the weight of the boat by depriving her of the engine and man, and towing her by the motor boat “Skidoo”. In this way he obtained his first success and by changes in the form and arrangement of the hydroplanes he was at last able to lift two men with the boat clear of the water by at least a foot. When loaded with three men bringing the total weight lifted up to 570 lbs (see experiments Oct. 23) the boat also lifted clear of the water but by a very little distance. The demonstration however, seemed to be a clear that the lifting power was sufficient at a speed of between 7 and 8 miles an hour to lift the engine and man so that the time had come for again trying the Dhonnas Beag under her own motive power. The experiment was made to-day with success.

This marks a decided and vigorous step forward. Mr. Baldwin's success is indeed a matter for warmest congratulations laying as it undoubtedly must, the foundation for radical change and wonderful advance in things nautical as well as aeronautical.

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3 Baldwin's persistent efforts will culminate in giving to the world an invention of supreme value through endeavors as earnest in the future as they have been in the past. G.H.B.

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CUTTING EDGES: By Gardiner H. Bell.

Each and every part of an aerodrome has its own peculiar function. The wires and struts hold the construction rigid, the sustaining surfaces sustain.

The vital importance of minimising head resistance is well known. Speed is essential. Lightness is essential. Since speed and lightness are both essential, the construction must necessarily be bulky, for in order to give light material strength it must have bulk. It therefore is of great necessity so to shape each part that it may be made to offer least resistance. Take two objects of the same thickness and area, and let their shapes be represented as above. Drive each of them edgewise through the air parallel to the line of advance so that they have no tendency to lift or depress. The resistance of No. 1 will be greater than that of No.2. Now in the first case when forms 1 and 2 are being driven through the air parallel to the line of advance they may be considered simply as parts of the construction which are to be gotten through the air with as little resistance as possible. Hence No.2 has the best shape because it offers the least resistance But take the second case and consider objects 1 and 2 as sustaining surfaces. Now incline them at a slight angle to the line of advance. The increase of lift of No. 1 over the lift of No. 2 will be great. 37 2 No. 1 has greater lifting power. Is not the theory of cutting edges as applied to the sustaining surfaces wrong, for the whole function of the sustaining surfaces is to sustain? Resistance in connection with any other part of the machine is to be avoided for as resistance it only retards the speed of the machine. But resistance in connection with sustaining surfaces means lift. Head resistance can easily be turned into lift by constructing a proper curve in the sustaining surfaces and offer it at a proper angle to the line of advance. Slope back your cutting edges of your sustaining surfaces and you reduce resistance. Display it perpendicular to the line of advance and your resistance is at its maximum hence your lift. G.H.B.

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(From Hammondsport Herald, Oct. 28, 1908). SILVER-DART FINISHED.

To Go in the Air this week — Many Aeronautical men expected. The fourth flying machine of the Aerial Experiment Association is finished and in the tent on Stony Brook farm. The engine is also completed and is being thoroughly tested at the shops. It is expected that a flight will be made to-day or to-morrow. The Association is receiving messages from all parts of the country for the date of the try-out, as a large number of aeronautical men will witness it.

A DOG TRIES THE SILVER-DART. (The following is from the Hammondsport Herald, Oct. 28, 1908):—

H.M. Champlin's pointer tried out the flying machine, Silver-Dart, the other night in the tent on Stony Brook farm. It failed to support him, even on the ground. He did not confine himself to the aviator's seat, but climbed out on the wings, the silken surfaces of which were not sufficiently strong at one point to support his weight. He fell through and abandoned further experiments. The damage was soon repaired.

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THE OUTLOOK ON AVIATION: By Gardiner H. Bell.

It is interesting to note that Columbia University has organized a class in Aviation. At present there is but one student, but it is believed that others will soon take up the subject.

Charles J. Glidden seems to be the leading spirit of an airship line whose headquarters is to be in Boston. If reports are true Capt. Baldwin has received the contract for building the Company's machines.

A.V. Wilson a resident of the State of Maine has an aeroplane which is built to sustain itself in the air without the use of a motor.

Gen. Allen is very anxious that Congress should appropriate $1,000,000.00 to be used in carrying on experiments in the Army.

The motor which Mr. Herring uses on his aerodrome is no less wonderful than the rest of his machine. It has five cylinders, weighs 19 lbs., and develops 25 horse-power. The cylinders are arranged about a central shaft having a bore of about three inches. If these figures are correct it is the lightest engine for its horse-power in the world.

Count Zeppelin's dirigible has been re-constructed and is again flying in Germany. Not long after the accident to his dirigible in August a sum of $750,000.00 was raised by the people of Germany to help Zeppelin to continue his work. This gives us some idea of the attitude Germany has taken towards navigation of the air.

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2 In a trial a few days ago the English aerodrome met with an accident. It is believed that the machine succeeded in rising from the ground, but no flight of consequence was made.

It may be interesting to note a communication from Paris, which appeared in the New York Tribune, October 28, 1908.

Paris, Oct. 22 :— The Aero Club of France has decided to organize a big aeroplane meeting in the autumn of 1909, when the Grand Prix d'Aviation will be competed for. The value of this prize is $2000.00 and there will be other awards. The course will be laid out over the flat country in the Champagne or Beauce region. The flights will be judged for both speed and duration."

The month of November brings forth a new aeronautical Magazine "Fly", edited by Alfred W. Lawson. G.H.B.

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One of the most important flights in the history of aerial navigation was made by Henri Farman in France on October 30, 1908. Faramn covered a distance of 20 miles in as many minutes. It is the first cross country flight on record, being made from Mourmelon to Rheims a distance of 20 miles.

M. Ble i r iot narrowly escaped a bad smash in endeavoring to climb for the French Altitude prize. The wires leading to the control had been crossed by mistake so that any manipulation on the operators part reversed the desired effect.

The interest of Germany seems to be centered chiefly in dirigible balloons at the present time. Prince Henry of Prussia and the Emperor himself are largely the cause of this interest, although Germany has always been inclined towards the lighter-than-air machines.

The Germans seem very anxious that Wright should make the talked of flight across the English Channel now that Farman has made the first cross country trip on record. But even from an unprejudiced point of view one cannot help feeling that to make such a trip would be a definite feat in the progress on aerial navigation.

France is in possession of a new dirigible balloon owned by Mr. Clement of the French Clement-Bayard firm. The dirgible made its maiden voyage on October 30 carrying seven passengers. Throughout the trial the dirgible answered its helm perfectly. It is built after the model of the “Ville de Paris”. Driven by a 120 H.P. Bayard motor, its five meter wooden propeller makes about 350 revolutions per minute.

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HOME NOTES.

There seems to be a good deal of vigor in the aeronautical world in Texas. Dr. J.F. Fielding, a Texas man, who won the first prize in the Chicago Balloon races, is the leading spirit. He is anxious to promote the use of dirigibles and balloons in Texas as be believes that the Texas gas contains peculiar qualities which would have advantage over that used elsewhere.

At Morris Park the monoplane of C.W. Williams seems to have created some interest which may be worthy of notice. The following is quoted from the Post Dispatch, St. Louis, Mo. Oct. 21, 1908:—

“While the spread of the planes in the Williams machine is 30 feet, the framework on which the canvas is stretched is constructed to fold back on itself when the machine is not in use, making the monoplane much less cumbersome than one fixed with planes and more easily handled on the ground.

The whole sustaining surface of the four planes is about 600 square feet and the weight of the machine, making the sustaining proportion about one pound to the square foot. This is considerably lower than any other aeroplanes in practical use.”

It is reported that Frank J. Heinfelt of Dayton, Ohio, made a successful flight of 1500 feet with a monoplane on Oct. 27, 1908. G.H.B.

BULLETINS OF THE Aerial Experiment Association

Bulletin No. XIX Issued MONDAY, NOV. 16, 1908

ASSOCIATION'S COPY.

BEINN BHREAGH, NEAR BADDECK, NOVA SCOTIA

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EDITORIAL NOTES AND COMMENTS .

This Bulletin is devoted specially to thoughts suggested by the disaster in which our Secretary Lieut. Selfridge met his death.

For the fine photograph of Lieut. Selfridge which forms the frontispiece of this number we are indebted to Mr. Conrad Frederic Haeseler, a former pupil of the Pennsylvania Institution for the Deaf at Mt. Airy, Philadelphia. Mr. Haeseler was born deaf and educated exclusively by the oral method having entered school on the first day that the oral class was begun. He was the first pupil to graduate, under the oral instruction, from that Institution, and the only one of the original class that finished the entire course of instruction. He was the first pupil, sent to a hearing school from the Mt. Airy Institution, having been placed in the school of industrial art in Philadelphia where he earned three scholarships in three successive years. This with two additional years at the Pennsylvania Academy of Fine Arts, gave him fully six years of active art study. At the end of that time he became interested in photography, in which his father (Albert S. Haeseler) encouraged him, as being a more practical occupation for a deaf man. This has resulted in the establishment of a large photographic Studio, and a reputation enjoyed by no other Philadelphia photographer. Mr. Haeseler has certainly succeeded in producing the finest and most natural photograph of Lieut. Selfridge I have seen.

Mr. Winfield Scott Clime, Photographer of the Department of Agriculture, is spending his vacation at Beinn Bhreagh and giving us the benefit of his expert services in photographing 2 apparatus here. Mr. Clime was present at the disaster to Orville Wright's machine when Lieut. Selfridge lost his life and took the ? l ast photograph of the machine in the air. He had just finished the exposure and was changing his plate holder when the accident occurred. He was the first person, with the exception of two mounted soldiers, to reach the scene of the disaster and go to the aid of the injured men. When the propeller broke he was standing quite close to the aerodrome shed and had thus an exceptional opportunity of observing what happened. The account which he has been kind enough to write for us contains some new points not hitherto touched upon I think by other observers. He is decidedly of the opinion that the machine, instead of diving head down as others have led us to believe, began with a stern dive with the front control up in the air. After falling about half the distance to the ground moving backwards a short distance it resumed its horizontal position for a moment and then dived head downwards on a reversed path. He thinks that Mr. Wright was regaining control of the machine when it struck the ground and that if the accident had occurred at a considerably greater elevation in the air, we would have succeeded in averting the catastrophe.

This is an entirely different account from any other I have seen and is not corroborated by any published evidence so far as I know. Former accounts have been written by witnesses who were at a great distance away. Mr. Clime was near at hand and had a side view of the apparatus. His observations therefore are more likely to be correct than those 3 3 of distant observers. An examination of the plan surfaces of the Wright aerodrome led me to think that the center of gravity was not further forward than the center of surface and may even have been a little behind it, in which case we might expect a stern dive to begin with followed by an oscillation bringing about a front dive just as Mr. Clime describes it. His observations are certainly entitled to careful consideration. A.G.B.

4

THOUGHTS SUGGESTED BY ORVILLE WRIGHT'S DISASTER OCT. 25, 1908: by Alexander Graham Bell

In the case of the accident to Orville Wright's flying machine, we have reason to believe that a propeller blade caught in one of the rudder wires; and that the propeller and the wire both broke, leaving the machine with a single propeller in operation and with its steering gear out of order.

Now Orville Wright's two propellers were placed one on either side of the longitudinal axis of the machine. Thus it happened that when the right propeller broke, the left propeller continued pushing, not in the central line of the machine, but on the left side of it; and the machine at once turned sharply to the right.

It is obvious that such a turning action, if not quickly neutralized by steering to the left, would cause the machine to move in a circle of small diameter, or even to spin round like a top, a condition not favorable to support in the air, if indeed not absolutely fatal to it.

The only thing possible for Mr. Wright to do under the circumstances was to shut off power and attempt to glide to the ground. This he did with disastrous results to himself and his passenger.

The fatal result to our friend and associate, Lieut. Selfridge, brings home to us, as nothing else could do, the advisability of studying closely all the causes that could lead to such a catastrophe, so as to avoid them in our future experiments.

The accident shows us how careful we should be to see that our propellers have plenty of room; and that there 5 2 should be nothing near them that could possibly catch, or that could possibly be drawn within reach of a rotating propeller by the powerful suction exerted by one face. The breaking of a propeller in the air may evidently become a serious matter, and we would do well therefore to make absolutely sure that our propellers are constructed of such strong and sound material that they could not possibly break under the centrifugal force generated by their rapid rotation; and that the blades are so stiff that they could not break by bending under the pressure of the air driven from them. In Laboratory experiments we have had propellers smash from all these causes, and we cannot be too careful in our inspection of propellers to be used in actual flight.

We may learn also from Orville Wright's experience that double propellers, rotating in opposite directions, although exceedingly desirable because they eliminate the disturbing effects of torque and gyroscopic action, introduce an element of danger when arranged as in the Wright machine.

It might perhaps be safer to use concentric propellers both pushing (or pulling) in the central line of the machine. Then if one is put out of commission, the other will continue pushing in the central line and not to one side of it. Some disturbance of equilibrium might still result from unbalanced torque, or gyroscopic action, but the danger would not be so great as when combined with an ex-centric push.

With concentric propellers two engines, one for each propeller, might be of advantage; for should one of the engines break down in the air both propellers would not stop. 6 3 One of them would still continue in action pushing in the central line. It is hardly likely that both engines, or both propellers, would give way at the same time; and, in case of accident to one, the aviator would not be obliged to come down at once without being able to choose his place of descent.

When the accident at Fort Meyer occurred, Mr. Wright did not know exactly what had happened, for the rudder and propellers were behind him, and therefore out of his sight. He did not dare to look round very much, for the operation of his controlling levers demanded all of his attention at the time.

This emphasizes the importance of the suggestion made by Mr. F. W. Baldwin that the moveable parts of an aerodrome should be placed in front of the aviator as much as possible, so that he may keep them under constant observation (see discussion concerning front and rear controls, Bulletin XVI, pp.36–44). If anything went wrong he would then see at a glance what had happened, and would be in a better position to meet the emergency.

Mr. Baldwin suggests that the vertical rudder should be placed in front of the machine instead of at the rear like the horizontal rudder known as the “front control”. In both cases the natural and proper position would seem to be at the rear; but no inherent reason exists why the vertical rudder should not be able to operate in front, at least as well as the front control.

Where it is impracticable to put moveable parts in front, it might be worth while considering whether a fixed 7 4 mirror in front might not be of advantage into which the aviator could look and see the moving parts behind him, or on either side, without the necessity of turning his head.

The Wright machine, after the accident, was found with its head pointing in a very different direction from that in which it was going when the propeller broke, suggesting the idea that it had spun around at least 90° before it reached the ground, and had thus lost its motion of translation through the air. Whether or not this was the immediate cause of the disaster to the Wright machine, it is safe to say, that under present conditions of aerodrome construction, loss of headway is the greatest danger the aviator has to fear . This, I think, will be admitted by all.

But why should loss of headway be accompanied by danger? This is of the greatest consequence for us to determine for a machine may lose headway at any moment from causes that are quite beyond our control. An engine may break down, a propeller may go, even an unexpected gust of wind may stop our machine for a moment, and at once danger results. What usually happens under such circumstances? The machine turns head down and dives. What does this indicate? That the machine is not properly balanced when headway is lost. The turning down of the head shows that the center of gravity is too far forward for a good balance when headway is lost. The advanced position of the center of gravity is then the cause of the danger .

Now it is somewhat disconcerting to find that the tendency of progress in the Hammondsport experiments has been to advance the position of the center of gravity in our machines. 8 5 This has been done by bringing the place of the aviator further forward in the machine than before, by omitting the tail, by using a heavier front control, and by putting the front control at a greater distance from the main supporting aeroplanes. We should give grave consideration to the question whether these changes have, or have not, increased the danger to the aviator in the event of loss of headway.

But why should there have been this tendency of progress in our experiments to bring forward the center of gravity. I think it results from the fact that we naturally desire that our machine should be properly balanced when in rapid flight. The June Bug, in its early days used to climb under the full power of the motor. Instead of remedying this defect by the use of a larger front control we advanced the place of the man, thus violating the important principle that changes of equilibrium should be balanced by the action of moveable surfaces, rather than by changes in the position of the center of gravity.

The center of pressure of course is further forward when a machine is in motion, than when it is stationary in the air; and, in order to be properly balanced, the center of gravity should come under the center of pressure.

The following propositions are important and interesting and should be fully discussed:—

1. If the machine is properly balanced when it has no headway, it will become unbalanced when headway is gained. The head then turns up, with a tendency to continue the turning movement until the head points vertically upwards towards the sky.

9

6 2.If an aerodrome is properly balanced while it has headway, it will become unbalanced when headway is lost. The head then turns down, with a tendency to continue the turning movement until the head points vertically downwards towards the ground.

Both are dangerous conditions, but there is a noteworthy difference between them:—

3. We can correct the climbing tendency by steering down with the front control, because there is headway; but we cannot correct the diving tendency by steering up, because there is no headway.

You cannot steer a boat without headway far less a flying machine. The first condition is far safer than the second.

When there is no headway the front control can no longer exercise its function as a horizontal rudder. When turned up at a positive angle to the horizon it is no longer pushed up by the pressure of the wind of advance. For the same reason there is no air pressure against it to push it down when turned at a negative angle. It is merely passive in its action and resists the very upward and downward turning movements it would cause in its active condition.

Where the machine is head-heavy when headway is lost, as in the second case noted above, the machine tends to turn downwards at the head, and the surface of the front control resists this turning tendency.

At first sight it would appear that by increasing the surface of the front control we could prevent a dive, but consideration will show that this is not so.

When headway is lost, the presence of a front control will not prevent the tendency of a head-heavy machine to turn head downwards, however large its surface may be, or however 10 7 far out it may be placed in front of the main supporting aeroplanes. The most it can do is to retard the turning movement. It cannot prevent it. The machine retains a tendency to turn completely over until the head points vertically downwards towards the ground.

This is a dangerous tendency not fully realized by us, I think, and the cause not clearly understood by all. Let me try to explain the point.

In a stationary machine if the center of gravity is too far forward for correct balance the machine turns over in front and dives. If it is too far back it turns over backwards and dives stern down; and the safe position for the center of gravity lies somewhere between. Is not this point the geometrical center of surface of the whole machine — the geometrical center of all the surfaces concerned including the front control?

When the machine falls without any motion of translation in the horizontal direction it acquires "downway", not "headway"; and the geometrical center of surface becomes the center of pressure or resistance.

Now as the machine falls the extended surfaces resist the motion, being pushed upwards as it were by the air pressure below. If therefore the center of pressure and the center of gravity are not in the same vertical line, a turning couple is produced which tends to turn the machine around an axis between the centers of pressure and gravity: Or rather in this case, the center of pressure is itself the axis of rotation, for though the air pushes upwards against the surfaces, 11 8 it does not succeed in pushing them up, they are falling all the time. It only succeeds in retarding their drop, so that they fall more slowly than the center of gravity and thus produce the turning effect.

Now when there is no headway it appears that the center of pressure is in the geometrical center of surface. If this is so it follows, that if the center of gravity is displaced from that position, either forward or backward, or to either side, the machine tends to turn over on the heavy side until the center of gravity comes vertically under the center of pressure. With a head-heavy machine the tendency would be to turn completely over forwards until the head points towards the ground, and no front control could prevent it if the machine has no headway. Here lies the danger. It is obvious that we must study the cause of this tendency and combat it if possible. Perhaps a simile may make my position more plain.

Substitute for the center of gravity, the bob of a pendulum; and, for the center of pressure, the axis which supports it.

Now hold the pendulum out horizontally from its point of support and allow it to drop. The pendulum will then turn upon its axis until the bob comes vertically beneath the point of support. No resting place is found until that position is reached.

Now can we prevent this action by giving the pendulum a front control? Prolong the rod of the pendulum as far as 12 9 you like beyond the bob, and attach to its extreme end a resisting surface which may be as large as you choose. Now hold the pendulum out horizontally as before with the resisting surface also horizontal and let go. The pendulum will swing more slowly than before on account of the resistance of the front control; but the point I would enforce is this, that the resisting surface however large and however far removed from the axis of rotation, will not prevent the turning movement from continuing steadily to the very end, when the center of gravity comes directly beneath the center of support.

The same is true of an aerodrome which is head-heavy in the slightest degree. The front control will not prevent it from turning completely over, head down, if it has no headway: Only headway can save it.

Now it is noteworthy that an aerodrome with its center of gravity at the center of surface does not have this tendency to continue turning over ,even though it should be tipped one way or the other.

Suppose it should be tipped slightly down in front. It would begin to slide down an inclined plane; but gravity has no tendency to make the dive become steeper, as would be the case were it head-heavy, stern-heavy, or side-heavy. On the contrary, from the very first gravity exerts a corrective influence. As the center of gravity tends to assume the lowest possible position its action is to lower the elevated side of the aerodrome, instead of depressing the lower side still more thus causing the surfaces of the aerodrome to return to the horizontal position.

13

10 This central position of the center of gravity, while it places the aerodrome in the safest condition if it has no headway, has its disadvantages. The surfaces will not remain

horizontal for any great length of time, but, under the action of the varying conditions met with in the air, will tip slightly one way or the other.

For example:— Let the surface tip down a little in front, and the machine glides down forwards in stable support so long as its headway is inconsiderable. As more headway is gained the center of pressure moves forward while the center of gravity remains behind at the center of surface. Thus as the machine glides downwards on its inclined path the center of gravity, being behind the center of pressure loads the machine down behind the axis of rotation, so that gravity over-balances the machine backwards performing the function of a rudder to steer the machine up to the horizontal position again. But during this process the machine has gained headway so that the turning movement would go a little further than the horizontal position, and the machine would begin to climb with its surfaces tilted up in front until its headway was exhausted and it came to a stop. The surfaces then being inclined downwards at the rear, the machine would begin to slide backwards down an inclined plane, but gravity would not act to increase the inclination. With the re-appearance of headway, which in this case would be stern-way, the center of gravity would be in front of the center of pressure and thus again act as a corrective influence to bring the machine up to the horizontal and beyond.

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11 Suppose that the original inclination should take the form of a tip to one side, then after ? g liding down hill a little way on that side, the machine would move up until its side-way was exhausted, and then commence a reverse glide down on the other side.

Thus, however the surfaces should happen to tip in the first instance, the machine would fall with an oscillating motion, first moving one way, and then reversing its path.

The inclination that could be most easily controlled by the aviator is the downward tip in front, so that the machine should gain headway rather than stern-way or side-way. This can be secured by having the center of gravity a little in front of the center of surface, only just sufficiently so to prevent the possibility of a stern tip. When the machine then begins to glide down hill in front, the headway gained will enable the aviator to use his front control as a rudder. The further movement of his machine would then be within his own control.

We are here of course dealing with a machine that has lost its motive power, so that the propelling power is gravity alone. The aviator, having secured control must preserve his headway at all hazards, or he will lose his steering power. He should be careful to keep his machine on the down-grade. Should he steer the machine on a horizontal path, or upon an up-grade, the resistance of the air would soon check his advance and he would be helpless until the machine should make another dive.

15

12 The important lesson to be learned is that the center of gravity, although it should be in front of the center of surface to secure a front dive when headway is lost, should be as little removed from that point as possible. The further forward the center of gravity is placed, the quicker will be the turning action produced by gravity and the steeper the dive that is necessary to restore headway.

Those conditions then are important which reduce the rapidity of the turning movement, so that there may be time to gain steering headway before the head has tipped down to a dangerous extent. The conditions that reduce the rate of turning are:—

1. The center of gravity as near the center of surface as possible, so that gravity may not have much leverage to help the turning movement.

2. The front control very far removed from the main supporting aeroplanes, so as to secure the advantage of leverage in resisting the turning movement.

3. Large surfaces upon the front control to increase its resisting action.

4. A horizontal tail very far removed from the main suporting aeroplanes, to retard the turning movement by the pressure of air upon its upper surface.

5. A large surface for the tail to increase its resisting action.

All these conditions tend to reduce the velocity of the turning movement, and therefore facilitate the acquisition of steering headway before the downward tip has become too steep for safety.

16

13 The conditions that increase the velocity of the turning movement, and hence increase the danger to the aviator when headway is lost are the reverse of these viz:—

1. The center of gravity far in front of the center of surface.

2. The front control near the main planes.

3. Small surfaces upon the front control.

4. The tail near the supporting aeroplanes.

5. The tail surface small, or omitted altogether.

A large front control well removed from the main aeroplanes, and a large horizontal tail equally far removed behind would give great longitudinal stability to the apparatus; and by this we mean in reality that the vertical turning movements would be slow.

It is desirable however, that when in motion we should be able to steer up or down quickly if we so desire; and by making the front control and the tail both moveable, we secure the very desirable combination of quick steering when in motion by moving both controls simultaneously so as to co-operate with one another, and slow turning when headway is los y t by holding both fixed.

There is still another point about the front control. The location of the axis upon which it turns is important. We are accustomed to place the axis nearer the frontedge than the rear, so as to secure the point that when the machine is in rapid motion the center of pressure of the front control shall fall upon the axis. This of course reduces the power 17 14 necessary to turn it because the air pressures are nearly balanced on either side of the axis.

But how about the operation of the front control when the machine has lost headway? In such a case the main surface of the front control being behind the axis of rotation and the center of pressure being also behind the axis in that case, an unbalanced pressure would exist upon the under surface of the front control when the machine begins to turn down in front for a dive, which tends to lift the rear of the front control, and cause the front control to be inclined downwards in front, thus assisting the dive instead of resisting it. Thus at the most critical time, when headway is lost, it would take more power to move the front control, than under ordinary circumstances when the machine is in motion.

Who knows but what this action may have contributed to the Wright disaster! With surfaces large enough to be difficult of manipulation under the ordinary conditions of rapid flight it may well be possible that the aviator may not have sufficient strength to resist the turning tendency of the front control at a critical moment of time when it is important that the surfaces should offer their maximum resistance to descent. Why would it not be safer to place the axis of rotation in the middle of the front control, so as to make it as easy as possible for the aviator to handle it when headway is lost.

If I am right in my various lines of reasoning, it is extremely important that the center of surface of the whole machine, when the front control is held parallel to the main aeroplane surfaces, should not fall behind the center of gravity.

18

15 I do not think it did so in the case of the Wright machine. I made a rough estimate of the area of the front control, of the area of the main surfaces, and of their distance p a part, and came to the conclusion that the center of surface, under the conditions specified above, came very near the front edge of the main aeroplanes. The center of grav e i ty appeared to be at about the same point, or a little further back, so that if the surfaces of the front control had been held rigidly in their positi i o n of maximum resistance I do not see how a disastrous dive could have resulted. The evidence however seems to point to the conclusion that the apparatus really did make a dive head first.

I can only understand this, upon the supposition that the front control was inclined at the XXXX time of the fall, either by the action of the aviator, or by the unbalanced pressure of the air below it when headway was lost.

It is obvious that if the surfaces were very much inclined the aparatus might perhaps have become head-heavy; and this head-heaviness would have been increased by the fact that the machine carried two men instead of one both seated at the front part of the lower aeroplane.

Suppose for example that in such a machine the surfaces of the front control should be turned into the vertical position instead of the horizontal, so as to be placed edgeways to gravity, then the whole support of the machine would have been thrown upon the main aeroplanes. The center of gravity would then be in front of the center of surface of the main aeroplanes, and the machine would become head-heavy.

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16 Of course it was impossible for the front control of the Wright machine to assume this vertical position on account of limitations to its motion. But if the surfaces where much inclined head-heaviness might perhaps have been produced though in a lesser degree.

Of course it is impossible to say exactly what happened in the case of the Wright machine; but I would urge upon the Hammondsport members to calculate and make sure that the center of surface of the Silver-Dart is not behind the center of gravity when the front control is placed in its most resistant position. I would also have them consider the advisability of placing the axis of rotation in the middle of the front control rather than further forward.

There is one other point and I have done. In an aerodrome without headway a stable condition results when the center of gravity is in the same vertical line with the center of surface.

1. If the center of gravity be vertically above the center of surface, then, though the machine is balanced, it is in a state of unstable equilibrium, like a walking-cane standing upright upon its end.

2. If the center of gravity be below the center of surface, we have a stable condition with a liability to swing, like an oscillating pendulum hung from its support.

3. If the center of gravity and the center of surface are absolutely co-incident, a stable condition results which the action of gravity cannot disturb. This point is well worthy of consideration.

In conclusion it seems to me desirable that the center of gravity should be a little in front, and a little below the center of surface; but that the displacement from this safe 20 17 position should be as slight as possible, and only sufficient on the one hand to prevent the possibility of a stern dive, and on the other to be certain that the machine will tend to keep right side up. A.G.B.

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A FEW THOUGHTS CONCERNING WRIGHT DISASTER: By G.H. Curtiss.

Hammondsport, Oct. 30, 1908: — I have been reading with great interest your paper on the cause of the Orville Wright disaster. Your deductions are confirmed by our experience with the "June Bug".

When the aviator sat close to the main surfaces, good landings were invariably effected, the rear wheels usually striking first. As we moved the aviator forward, the machine showed a tendency to pitch down and strike on the front wheel first when the power was shut off. I would suggest the following method of overcoming this difficulty.

Balance the aerodrome so that it will glide a y t a low speed of 12 or 15 miles an hour. Place the propeller well above the center of resistance so that as the speed increases, and the center of pressure travels forward, the tendency to lift in front will be overcome by the push of the propeller and the machine should fly at, say, 40 miles an hour with the front control in a neutral position. Should the engine stop, the tendency to pitch down forward is neutralized by the absence of the thrust in the upper part of the aerodrome.

While the push of the propeller will not exactly balance at all speeds the change in the center of pressure, the difference can be taken care of by the front control.

G.H.C.

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A FEW THOUGHTS CONCERNING WRIGHT DISASTER: By F.W. Baldwin.

Beinn Bhreagh, Nov. 11, 1908 :— My candid opinion is that we will never know exactly what did happen to Mr. Wright, nor learn any useful lesson from such meagre and conflicting accounts as we have of the disaster.

Unless Mr. Wright himself should see fit to enlighten us there is very little to base our deductions upon. The indirect cause of the loss of control we know was due to the turning action produced by the eccentric thrust of the unbroken propeller. The lesson from this is very clear and convincing but further than this it seems dangerous to speculate as to the immediate cause of the subsequent dive which really wrecked the machine. Our knowledge of the facts is very limited indeed.

Without the least disparagment to Mr. Clime who was one of the many first to arrive at the scene of the disaster, or to the version of it, which he was good enough to give us the benefit of, it is only right to note that such was their excitement that eye witnesses could not agree even as to which propeller broke. Now if we are to arrive at any useful conclusions it seems to me that we must confine ourselves to the facts and reason only from that which we know to be true. There are so many plausible explanations that when we consider the extreme likelihood of a combination of any number of these a diagnosis of a cause and effect is almost certain to be astray.

If a critical study of the Wright's machine should disclose any defect it would of course be decidedly helpful, but for my own part I can find nothing faulty either in 25 2 principle or design. While I attach no importance to my own views upon the subject, in the hope of illustrating the complexity of the problem, I will suggest two other factors which may have contributed to the accident.

First. Was Mr. Wright's aerodrome well balanced in a vertical sense? That is, was the line of the propeller thrust at or near the center of resistance, or was it above this point?

Second. Was not the center of gravity too low giving a pendulum action tending to increase the amplitude of any swinging motion. Both of these features, if true, would be accentuated by the additional weight and head resistance of a passenger in a two man flight as Mr. Wright had it arranged.

All that we really know of the actions of the machine could be most reasonably explained by the thrust being above the center of resistance, and the center of gravity being below the center of resistance. I do not for a minute claim that this was the cause of the accident, nor would I like to infer it, but from looking over photographs of Mr. Wright's machine, it seems at least as reasonable as that it was head-heavy as suggested by Mr. Bell.

The uneasy pitching and scending observed previously when Mr. Wright flew in a gusty breeze may have been caused by the propeller thrust being above the center of resistance and the center of gravity acting as a pendulum.

On the other hand this tendency may have been due to the rotary motion of the wind, so that when as simple an action as this is open to argument, it seems hopeless and unscientific to make deductions from such flimsy premises as we 26 3 have.

Mr. Bell's simile of a pendulum does not seem to me to be very well chosen in as much as the axis about which an aerodrome tends to turn is not fixed.

Mr. Bell says:—

“When headway is lost, the presence of a front control will not prevent the tendency of a head-heavy machine to turn head downwards, however large its surface may be, or however far out it may be placed in front of the main supporting aeroplanes. The most it can do is to retard the turning movement. It cannot prevent it. The machine retains a tendency to turn completely over until the head points vertically downwards towards the ground”.

This would undoubtedly be true were the center of surface (or whatever point the machine tended to turn about as an axis fixed in the air) but is this the case. Let the machine lose headway and fall in this way. If it be only slightly head-heavy the turning action will then be slow. It will quickly acquire headway due to the horizonally resolved component of pressure being a propelling force. The machine, axis and all will then move forward, the center of pressure regain its position vertically above the center of gravity and balance be restored without the machine showing a continued tendency to turn completely over until the head points vertically downwards towards the ground.

Mr. Bell's general conclusions are of course correct and should guide us in not producing a badly balanced machine. I do not quite agree with what he says about the axis for a front control. To pivot it at the center of surface would give us a still more dangerous arrangement. The center of pressure would be in front of the axis at high speeds, a position 27 4 of unstable equilibrium which would make control difficult and loss of control much more dangerous than as we have it at present.

I think we will learn more from a careful study of the Wright's machine than by guessing as to what happened to it in the air. F.W.B.

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THE WRIGHT ACCIDENT BY AN EYE WITNESS. By W.S. Clime.

As had been my daily custom since Mr. Wright's arrival at Fort Meyer, Sept. 17 found me at the Fort again to witness another of his spectacular flights. The missing of a car made my arrival at the Fort somewhat later than usual that evening, and upon reaching the south end of the field, the motor was already humming out its warning note that the flight was about to begin. Deciding to remain where I was and desirous of securing a photograph of the machine before it acquired the normal flying height, I awaited its coming, and exposed a plate as it swept by with the grace and ease of a soaring bird. For several complete circuits of the field the flight was uneventful. The novelty having worn off to such an extent that one no longer kept his eyes glued to the machine, but only gave a glance upward when it went directly overhead. It was at such a time that Wright could be seen, hands on levers looking straight ahead, and Lieut. Selfridge to his right, arms folded as cool as the daring aviator beside him.

While walking over to the aerodrome shed and in front of it, after having made an exposure on the machine directly overhead, there was a crack like a pistol shot coming from above. Looking quickly up I saw a piece of a propeller blade twirling off to the southward. Realizing instinctively that something terrible was about to happen, I stood riveted to the spot for a moment with my eyes on the machine. For a brief period it kept on its course, then swerved to the left and with a swoop backwards, but in an almost perpendicular 29 2 manner it fell for half the distance to the ground. Then suddenly righting itself regained for an instant its normal position only to pitch forward and strike on the parallel planes in front for altering the elevation, raising an immense cloud of dust that momentarily hid it from view. The terrific impact instantly reduced the structure into an inconceivable mass of wreckage, and it was apparent that the machine was partially inverted, the skids being on the top, and the machine lying in a position at right angles to its course when the accident occurred. At topmost speed I ran over to where the machine lay and found that two mounted soldiers had preceded me by a few seconds. Throwing my camera to the ground with sufficient force, as I discovered later, to know all of my plates out of the holders, and break half of them, I caught hold of one of the curved surfaces and with all my strength pushed it up and broke it. Mr. Wright was under it and a few feet from me apparently in great pain and moaning. He had fallen across a wire stay and one of the struts of the machine, and was suspended by his chest and stomach. His feet were barely touching the ground, and his hands were hanging limp; blood was streaming down his face and trickling in a tiny stream from his chin, but he was conscious and feebly said, “help me”.

Lieut. Selfridge was lying on his back almost directly beneath Wright, but to Mr. Wright's right. One of the enlisted men reaching over caught Mr. Wright around the body and lifted him clear of the wreckage. It was then that he exclaimed “Be careful of my leg”. It is exceedingly difficult 30 3 to describe with exactness just what ones movements were during the intense excitement of the moment. I have a hazy recollection of the two enlisted men and myself lifting up and carrying Mr. Wright clear of the debris, and laying him on the grass. Turning back to the machine we tried our utmost to reach Lieut. Selfridge, who was lying on his back and had apparently struck the ground with the back of his head and base of the spine. His knees were slightly drawn up due perhaps to the wreckage beneath him. Wire stays, pieces of canvas and broken struts were piled in confusion about him, and it was impossible for the few at hand to do more than feebly attempt to reach him. His face and clothing were covered with blood. He was unconscious and if he spoke at all I did not hear him.

The last rays of the setting sun were gone, the dampness of night was in the air, and a slight fog was already enveloping the distance. The silence was unbroken save for the low moaning of Wright, and as I looked about me in a helpless sort of way a wierd spectacle presented itself; horsemen were galloping madly across the broken field in our direction. A picture of my idea of a cavalry charge in actual battle, and in their rear a mass of humanity blended together by the twilight into a low black line, and approaching with ever increasing rapidity. It took but a few minutes for the horsemen to travel the third of a mile to the wreck and on their arrival pandemonium broke loose. Orders for the ambulance shouts to prevent smoking and striking of matches, the odor of gasoline from the broken tank being strong in the air, the 31 4 pushing back of the ever increasing crowd by the soldiers and the rushing here and there of newspaper correspondents and photographers. A striking contrast to the former period of deathly stillness, but a relief to ones overwrought nerves. Willing hands soon extricated Lieut. Selfridge from the wreckage and physicians at hand administered as best they could to the two injured men. After what seemed an interminable length of time two stretchers were brought to the scene, and the unfortunates placed upon them and carried across the long field to the hospital.

The diversity of opinion as to which propeller was broken, was probably due to the peculiar position in which the machine lay. In some manner too quick for me to perceive, the machine turned at right angles to its path of flight and was headed to the northward when it struck the ground. The wreck was so complete that it was difficult to make out its original construction, but that it was the right propeller I am convinced, as I distinctly remember noting that the propeller toward the east had both its blades broken off completely, while the one toward the west was unbroken. This would have made it the starboard propeller that was broken. Photographic evidence has since corroborated this fact.

I agree with Mr. Wright that if the propeller had broken at a greater distance from the ground, the accident would not have occurred, the machine was regaining its equilibrium when it struck. The accompanying diagram will explain the position of the machine, and my own at the time of the accident. W.S. Clime.

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FIELD ABOUT ONE MILE IN CIRCUMFERENCE

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THE LESSONS TO BE LEARNED FROM THE WRIGHT DISASTER? By Gardiner H. Bell.

We are very greatful to Mr. Clime for the article he has written concerning the Wright disaster at Fort Meyer. Mr. Clime had undoubtedly a position of great advantage from which to view the accident, and he had the good fortune of being the first civilian on the field.

It has been suggested that if we knew just what took place after the breaking of the propeller while the machine was in the air, many valuable lessons might be learned from the accident. Undoubtedly we should gain much if we could know the actions of the machine when the propeller broke; but is this not impossible?

It is very difficult to follow the manoeuvres of a body in mid-air: It may be because the eye has no definite background by which to gauge the direction of a moving object, but however this may be the fact is important and only goes to show the helplessness of deducting practical knowledge from such a case as this.

We are told that there was a report like that of a pistol; the machine lurched forward a few times and came to earth. Following this the utmost confusion reigned. The crowd one and all rushed madly to the scene of the disaster. Somebody called for an ambulance.

It was interesting to know the different views on the subject of what happened, but technically they can be of no importance.

We are asking a man to describe accurately what happened in the space of a few seconds. We are not taking into 34 2 consideration the intense excitement immediately following which alone is enough to block from the mind of the calmest the most commonplace circumstances. We are asking a man to describe accurately the manoeuvres of a machine driven through space, performed with out warning in the twinkling of an eye. We are not taking into consideration the tremendous rapidity with which the machine performed those curious manoeuvres in mid-air. We are asking him to put down in black and white that which he actually saw, yea, that which actually happened, so that the world may know — and benefit by the knowledge.

No two stories are the same. The view of the local press agent is of little importance. He was there. He saw it. Therefore it was his duty as a press agent to relate exactly what happened in detail. He did not realize, or it was not his business to realize, that there was very reason why he should not know what happened; and if he goes on telling the same story to a new victim each time, with a few variations, he will very likely, in time, believe it himself. G.H.B.

BULLETINS OF THE Aerial Experiment Association

Bulletin No. XX Issued MONDAY, NOV. 23, 1908

ASSOCIATION'S COPY.

BEINN BHREAGH, NEAR BADDECK, NOVA SCOTIA

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Bulletins of the Aerial Experiment Association .

BULLETIN No.XX ISSUED MONDAY NOV. 23, 1908.

Beinn Bhreagh, Near Baddeck, Nova Scotia .

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EDITORIAL NOTES AND COMMENTS.

Patent Matters .

Beinn Bhreagh, Nov. 18, 1908: — I have just received from Mauro, Cameron, Lewis & Massie 3 copies of a proposed application for a patent on the Hammondsport machines. One of these has been sent to Mr. Curtiss for the information of Mr. McCurdy and himself. Another has been placed in the hands of Mr. F. W. Baldwin and the third I retain myself. It now becomes our duty to examine this specification with care and especially to study the claims; for the protection afforded by a U S Patent is limited to the matter claimed.

It is too soon to offer any opinion upon the specification as a whole, but it is obvious that some of the terms employed need definition. Nearly all of the claims submitted are combination claims, and one of the essential elements in most of these combinations is “A plurality of superposed suitably spaced aeroplanes each having a concave and a convex surface”.

Now the thought immediately occurs how is it possible for a plane to have a concave o convex surface. Etymologically speaking this is an absurdity and a contradiction of terms; for in plain English it means a flat surface which is not flat.

We are all accustomed to the loose way in which the public employ the term “aeroplane”; but in a specification we must be specific. If one element of a combination claimed is impossible the whole combination is impossible and the claim null and void.

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2 We should not, in our specification and claims, employ the word “aeroplane” without a specific and well defined meaning. A definition is imperative in order to clear our proposed claims from absurdity.

Would it not be well for us to employ the word “aero-surface” as our general term; and limit the word “aeroplane” to a substantially flat surface, distinguishing “aeroplanes” from “aero-curves”. A.G.B.

BALDWIN'S EXPERIMENTS .

Beinn Bhreagh, Nov. 18, 1908: — The attempt to use flexible hydroplanes of the hayrake type at either end of the outrigger truss to steady the Dhonnas Beag when she rises out of the water upon her hydro-surfaces has developed the point that the resistance of the submerged hayrake causes a twist in the outrigger truss.

The speed obtained by the Dhonnas Beag upon her hydro-surfaces has not so far been remarkable but it is to be observed that the center of gravity of the machine is so high that it becomes difficult to preserve the equilibrium of the boat when she is out of the water for a sufficient length of time to develop the full speed. Suffice it to say that up to the present moment the speed of the Dhonnas Beag has been greater without the hydro-surfaces than with them.

On Nov. 13 a decided advance was made in this respect. The Dhonnas Beag without any hydro-surfaces at all, making a speed of 18.5 miles per hour, a truly remarkable performance for a boat driven by an aerial propeller. 3 3 The unstable equilibrium manifested by the Dhonnas Beag has led Mr. Baldwin to design a new boat hull to be 30 ft. long and sufficiently wide and deep to allow both the engine and the man to be placed within the boat. He has had made quite a fleet of small wooden models differing slightly from one another, and I notice in the aerodrome shed a full-sized model in skeleton form. The boat is being designed to hold the new Curtiss engine now being used at Hammondsport on the “Silver-Dart” and the “Loon”.

Hammondsport Experiment ? .

Beinn Bhreagh, Nov. 18, 1908: — The experiments with the “Silver-Dart” at Hammondsport still hang fire. The trouble seems to be with the new water-cooled Curtiss engine. While the power of the engine is amply sufficient for every purpose (Mr. Curtiss has reported a push of 300 lbs) trouble has been experienced with the water-cooling arrangement and with the method of belt transmission.

Mr. Baldwin expressed the opinion that the engine, with all its appurtenances would weigh about 350 lbs. Mr. McCurdy now reports, in a communication describing the "Silver-Dart" which will appear in a subsequent Bulletin, that the weight is 365 lbs.

Engine, propeller, countershaft etc 210 lbs

Radiator 15

Water 30

Gasoline, oil and tank full 110

Total 365 lbs.

Trouble has been experienced with the slipping of the belt and chain transmission is now being tried. According to Mr. Curtiss this will envolve another construction 4 4 throughout, including a different fastening for the propellers. A balance wheel and other paraphernalia for the chain transmission.

Of course this will still further increase the weight of the engine, and what the final weight will be is one can tell. It becomes obvious however that the engine will be too heavy to be tried on the tetrahedral aerodrome No. 5. A.G.B.

GLOBULAR CONNECTION DEVICES.

Beinn Bhreagh, Nov. 20, 1908 :— We have taken advantage of the visit of Mr. W. S. Clime, photographer of the Department of Agriculture, to secure some good photographs of details of apparatus. In this Bulletin I give photographs of the Aluminum globular connection devices both turned and cast and a photograph showing the mode of attachment to the wooden struts. With these globular connections we can build tetrahedral cells of large size and great strength. The other Beinn Bhreagh photographs that appear in this Bulletin were also taken by Mr. Clime and still others will appear in subsequent Bulletins. Mr. Clime left for Washington to-day (November 20, 1908). A.G.B.

5 6 7 8

Curtiss to Mrs. Bell .

To Mrs. A. G. Bell, Baddeck, N.S.

Hammondsport, N.Y., Nov. 2, 1908 :— We have been greatly pleased to hear of Casey and Mr. Bell's success with hydroplanes. While we were temporarily held up for the motor for the “Silver-Dart”, John and I made a couple of light boats for the old “June Bug” to see what we could do on the water here, John's theory being that we could lift by the aeroplane as well as by the hydroplane. John has named the thing “the Loon”. It is all ready to try if we get an opportunity.

The engine is finished and in the “Silver-Dart”, and we expect to try it to-day. We have gotten a pull of 300 lbs direct from the machine resting on its wheels. This would probably be more were the engine in a swing as we have usually tried the propellers. We were obliged to give up the New York trip, which is perhaps just as well.

(Signed) G.H. Curtiss.

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Curtiss to Bell .

Hammondsport, N.Y., Nov. 11, 1908: — We are sending under separate cover by mail, seven each of five views of the “Silver-Dart”, which we trust will be suitable for publication. We have spared no trouble or expense in getting the right size and quality of paper.

The experiments with the “Silver-Dart” have been held up temporarily on account of two defects; one, the proper circulation of water for cooling the engine; second, the slight slipping of the belt transmission. These two belts work beautifully in every way except that they are not quite sufficient for the load. Two or more belts would eliminate all possibility of trouble on this score. We have made another pair of pulleys for two more belts, also a chain transmission which appeals to John as best. It will take another construction throughout including a different fastening for the propellers, but as the “Silver-Dart” is built according to plans and specifications of J.A.D. McCurdy, we do not want to use too much persuasion and are, therefore, getting up a balance wheel and the other paraphernalia for the chain transmission.

In the meantime, we are expecting to try the “Loon's” ability to rise from the water. The enclosed prints show what she looks like without the engine, but with a man's weight in the same position. Perhaps we have taken too much liberty in trying this experiment, but we thought no time was being lost and it would be fine to know what chances there are of raising from the boats. We will wire if anything startling occurs.

G.H.C.

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“Silver Dart's” first appearance.

Engine and transmission.

“Silver Dart” — .

11 147548-T

What it “looks like” with two on board.

147549-T

“Silver Dart”.

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Curtiss to Mrs. Bell .

To Mrs. A. G. Bell, Baddeck, N.S.

Hammondsport, N.Y., Nov. 12, 1908 :— I am greatly surprised to find it Nov. 12 and we not in Baddeck. The “Silver-Dart” has been ready for a week. John did not want to launch it until we were satisfied it could stay in the air an hour or more. This led to a lot of testing which developed faulty circulation and a leaky cylinder. It has taken some days to correct these troubles.

In the meantime we have fitted the engine in the “Loon” (the June Bug converted into a “water bug”); however, if the wind abates we will try this to-day. We have already sent you pictures showing you this craft afloat. I think it will settle for once and all whether it is possible to rise from boats, as the engine is very powerful and will, we believe, give twice the push that will be needed in the air. If it will not rise from the water with this power, it will be up to Casey and his hydroplanes.

(Signed) G.H. Curtiss.

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LESSON OF THE WRIGHT DISASTER: By G.H. Curtiss.

Hammondsport, N.Y., Nov. 10, 1908 :— In reference to the discussion on the Wright accident, I will say that the mishap was due, as we know, to the wire catching on one of the propellers. Just how this wire caught we will probably never know, but the fact that it did catch the propeller makes it the real cause of the accident. Precautions should be taken to prevent catching the propeller.

The use of the single or concentric propeller would, of course, greatly reduce the chances of accident in case the propeller should catch or break. I do not see how it would be possible to handle an aeroplane of the Wright type after one propeller had broken unless the power were shut off instantly and, even then, the momentum of the revolving parts might ? g ive force enough to the remaining propeller to cause the operator to lose control.

Aside from the above, the single propeller would be obviously advantageous in as much as the area covered by the sweep of the blades would be but one-half that of two propellers, which would lessen the chances of catching loose wires or other parts. G.H.C.

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THE LESSONS OF THE WRIGHT DISASTER: By J.A.D. McCurdy.

Hammondsport, N.Y., Nov. 11, 1908 :— Received your communication concerning the Wright disaster at Fort Meyer O.K. You, Casey, and Gardiner have certainly gone over the probable causes from all sides and I don't see that there is much left for me to say.

As you state in your article, the immediate cause of this accident was loss of headway, but how was this brought about? Certainly the breaking of a propeller would not cause sudden stoppage in the air and consequently leave the machine without motion of translation.

All the eye witnesses of the accident we talked with agreed that the machine first started on a gentle glide and as she gained speed, her course was diverted into an upward glide. Then the machine having lost her motion of translation turned upon end and dove.

The reason for her diving is of course u q uite obvious, the center of pressure at the traveling speed comes far in advance of the geometrical center of the surface, and the machine is balanced for its speed by having the center of gravity of the machine as a whole coincident with this point (center of pressure).

As the machine loses headway of course the center of pressure recedes till when the machine has no motion of translation the center of pressure coincides with the geometrical center of surface.

When the aerodrome is flying in a normal manner the front control, no matter how large or how powerful has no effect 15 2 on the position of the center of pressure located in the main plane because the angle of incidence of the control varies. At one moment it presents a negative angle of attack and the next moment it presents perhaps a positive angle of attack. But when the aerodrome has lost its motion of translation the front control comes into play and influences the geometrical center of surface of the machine as whole. It has been found by Mr. Chanute and others that two superposed planes separated from each other two thirds, or a distance equivalent to the depth of the planes, and falling so that the planes of the surfaces are at right angles to the line of descent, the top plane has 0.7 times the supporting power of the bottom plane. On this basis I have figured out the effect which would be produced in the Silver-Dart. Suppose that for some reason or other motion of translation should be entirely lost while in the air. The machine would turn on end as the Wright flyer did unless the front control was dropping relatively to the air at the rate of twenty to thirty miles per hour. In that case the moment produced by the eccentric loading would be entirely compensated for.

This velocity is much too great for safety and I would urge that a front control be used which would be large enough or out from the main plane far enough to thoroughly compensate for the eccentricity of loading at a speed of from 10 to 15 miles per hour. If such were the case a machine could not turn upon its nose and drop unless compelled to do so by the operator.

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3 My opinion of a rear horizontal tail is that it is a detriment in that it dampens the turning motion of the aerodrome and while it may tend to prevent a sudden turning it tends to depress the machine as a whole, whereas the bow control tends to support the machine as a whole and after the turning has taken place you would have to drop much faster than without the tail in order to right the machine.

I agree with Casey that it would be well to have all the controls in front of the operator and in fact we considered putting the “Silver-Dart's” vertical rudder in front but thought that to have the same turning effect it would have to be much larger than if placed at the rear because it would not be affected by the draft from the propeller.

The Wright disaster in my private opinion was caused either because Mr. Wright pulled the lever which elevates the machine too far or he became excited as he naturally might and pulled the lever unintentionally, hence losing his motion of translation. This is no reflection on Mr. Wright because he is, with his brother, beyond doubt the most skillful aviator we have. He is but human however, and he has been known to pull the wrong lever before.

In other words, I don't see how the breaking of one propeller providing the engine was shut off instantly (comparatively speaking) could cause the aerodrome to lose its motion of translation. J.A.D. McC.

17

REPORT OF BEINN BHREAGH LABORATORY: By William F. Bedwin, Supt.

Aerodrome No.5 .

Some work has been done on No.5 since my last report. We are now at work on some banks of cells to fill up part of the center section, leaving a triangular hole for engine and man support.

Floats for No.5 .

Have made a ladder 2m × 20 cm and fastened to it a rubber float inflated to 1.75 × 30 cm the whole weighing 1950 gms. Several of these are to be attached to bottom of machine. Have also tried the experiment of inflating a rubber tube in the bottom layer of cells of machine. This plan involves very little extra weight to structure but will not keep machine clear out of water.

New Boat Models .

We have made four models of a new boat for hydroplane experiments. The length over all in each model is 30 ft. No. 1 model had a maximum beam at bottom of 1‘-6“. No. 2 same dimensions with some changes in sheer and free board. No. 3 has maximum beam at bottom of 2 ft. 6 inches with practically same sheer and free board as Nos. 1 & 2. No. 4 has maximum beam at bottom of 2 ft. 3 inches with same sheer and free board as No. 3.

Have selected No. 3 as our model after some very warm discussions for and against between Mr. Baldwin and I. Have in stock all the materials necessary for the construction of this boat and have set up in aerodrome shed a rough set of moulds and sheer streaks to full size of boat to check up 18 our models lines. Am now making experimental piece of stock for ribs and strings to test out so as to get the very lightest sizes possible. We purpose planking boat with Basswood 3/16“ thick. Double on bottom and part way up sides with canvas and varnish between, and single plank on balance of sides and deck, I will be able in my next report to give more definite details of this boat.

Oionos Kite .

The white Oionos model of surfaces of No. 6 machine was completed some time ago. On Friday Nov 6. An attempt was made to fly it in field but unfortunately we did not put on any tail for first trial and machine jumped round so much in air that line broke and kite drifted away with wind and was completely smashed. Dimensions of this kite are given in my report (Bulletin XIII p.19) for all parts except body.

The body was spar-shaped, triangular in cross section 4 m long maximum section 50 cm, 1.5 m from front end. Body was securely fastened to wing piece and wired to the front and back edges of plane. Photos of this kite are appended.

? H ydroplanes.

Since my report of Oct. 6 we have made several sets of hydroplanes for the Dhonnas Beag, and attached them, and I will try to give a list of sizes etc. of different sets, leaving to Mr. Baldwin the report of results with each.

First set tried in Bulletin XVI p. 29. Had planes 10 inch by 1 ½ inch by 1/16 inch thick made of steel and were attached to boat as shown with board across bottom of forward s ? e t. Board 48 inch by 5 inch by 5/16 inch cypress.

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Second arrangements were of the same outfit with aft set arranged same as forward and boards 48 × 5 × 5/16 inch across bottom of both sets as shown in Bulletin XVI p.33.

Third set was a combination of first and second arrangement coupled with a set of hydro-curves. Angle of set back of these aprox. 20° curved 1 in 15, maximum curvature # back from front edge; size of these surfaces 3 inches wide by 74 inch long measured in front edge. There were two superposed surfaces on front edge in this part of arrangement as shown in Bulletin XVIII pp.24–26. These surfaces were made of galv. iron. 26 gauge.

Fourth set was the new portion of third set and a duplicate of it as to shape, attached as shown in Bulletin XVIII p. 30. This set measuring 3 inch by 56 inch on same line as noted Fifth . set. A combination of set back hydro-curves made of steel. Photos appended. Angle of set-back 55°, curved 1 in 10; maximum curvature one third back from front edge, measuring

1st plane 46 × 2 × 1/16

2nd plane 36 ½ × 2 × 1/16

3rd plane 28 ½ × 2 × 1/16

4th plane 20 × 2 × 1/16

Dihedral 28 × 2 ¼ × #

Sixth set. Now being attached are striaght across hydro-curves; curved 1 in 15 with ends rounded back. These planes are 3 inch by 24 inch by 1/16 inch made of steel.

New Kites .

We have finished a new half sized model of No.5 aerodrome, cellular part, beaded ready to fly as a kite. Have put no body in it as yet. This kite is 32 cells on top and 8 cells high, hollow construction and contains 758 winged cells 20 It weighs 42 ½ lbs.

Have under repairs the full construction half-size model of No. 5 aerodrome which will be the same outside dimensions as noted above, for ho o l low construction model.

Materials .

We have received into stock a supply of Monnot copper clad steel wire grade A. Sizes 9,14 and 20 B&S gauge. This is a new wire on the market and the manufacturers claims for it that it is absolutely non-rustable which will make it a very valuable wire for guying etc. in our apparatus It's tensile strengths are tabula y t ed as follows:—

No. 9 984 lbs.

No. 14 334 lbs.

No. 20 86 lbs.

These are breaking weights. Have received from Curtiss a shipment of goods including some large size cable and turn-buckle nipples, some tools etc. etc.

Propellers .

Some time ago we resurrected an old 4 bladed propeller started about 3 years ago but never finished. We had this finished up and mounted on Dhonnas Beag geared 8–24 and it gave us very satisfactory results. Pulling 100 lbs. and driving the boat 100 m in 12 seconds without any hydroplanes attached. Dimensions of propeller 2m, pitch 30° at tip, width at tip 25 cm, blades curved on pushing face.

We are now making a pair of propellers which will be ready shortly. Size diameter 6 ft. 2 inch, pitch 15° at tip, width of balde at tip 9 5/8“, curvature of blade 1 in 18 on 21 pushing face at tip.

Have on hand glued up blocks for the following sizes of propellers.

1 pair 6-0“ 25° at tip

1 pair 7-3“ 22° ½ at tip

1 single 7-0“ 20° at tip

10““ wide at tip.

10“ wide at tip

10“ wide at tip.

These blocks can of course be worked up into less pitch than noted above if desired.

We have started shaping up the pair of propellers 7 ft. 3 inches diameter; 22 ½° pitch. W.F.B.

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MODEL OF AERODROME NO.5, FLOWN AS A KITE Experiments Oct.12, 1908.

Beinn Bhreagh, Oct. 12, 1908 :— A half-sized model of aerodrome No.5, shown in an accompanying photograph, was flown to-day as a kite, in a very gusty wind from the North. 8 series of observations were made. 8 of wind-velocity, 80 of altitude, and 80 of pull. Total 168 observations.

In all the experiments the kite was flown by a one-quarter inch Manilla rope, 100 meters long, attached at the front edge of the kite structure at a point ÷ 100 cm from the center of the keel stick.

Exp. 1 Wind Alt Pull 14.25 35° 130 33° 100 31° 90 28° 80 38° 70 30° 80 31° 80 33° 70 38° 80 39° 60 336° 840 Exp. 2 Wind Alt Pull 14.31 37° 110 38° 150 35° 160 33° 120 37° 130 40° 120 34° 100 34° 130 30° 180 33° 200 351° 1400 Exp. 3 Wind Alt Pull 12.61 35° 150 36° 180 36° 110 35° 150 36° 100 40° 50 34° 80 35° 80 36° 40 35° 130 358° 1070 Exp. 4 Wind Alt Pull 14.40 33° 120 24° 100 25° 80 28° 75 32° 90 38° 110 40° 130 39° 110 32° 75 31° 65 322° 955 23 Exp. 5 Wind Alt Pull 13.95 31° 100 30° 100 30° 50 33° 100 33° 75 36° 170 35° 120 35° 120 35° 75 32° 110 330° 1030 Exp. 6. Wind Alt Pull 10.95 30° 100 31° 40 31° 90 32° 105 32° 90 31° 80 28° 50 33° 40 27° 30 25° 115 300° 750 Exp. 7 Wind Alt Pull 10.25 32° 80 31° 85 34° 70 31° 75 25° 20 22° 50 22° 30 20° 20 19° 15 24° 30 260° 475 Exp. 8 Wind Alt Pull 14.05 26° 120 33° 70 30° 60 28° 150 29° 100 30° 175 33° 100 29° 90 36° 80 36° 75 310° 1020

Summary of Experiments Oct. 12, 1908

Exp. Wind Alt Pull Obs Miles Obs Angle Obs lbs. 1 1 14.25 10 336° 10 840 2 1 14.31 10 351° 10 1400 3 1 12.61 10 358° 10 1070 4 1 14.40 10 322° 10 955 5 1 13.95 10 330° 10 1030 6 1 10.95 10 300° 10 750 7 1 10.25 10 260° 10 475 8 1 14.05 10 310° 10 1020 Summation 8 104.77 80 2567° 80 7540 Average 13.10 mph 32°.09 94.25 lbs.

G.H.B.

(approved A.G.B.).

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KITE EXPERIMENTS WITH CYGNET MODEL AND MODEL OF AERODROME NO. 5, OCTOBER 31, 1908.

Beinn Bhreagh, October 31, 1908 :—Mr. Bedwin reports kite experiments made this morning in a high wind averaging 23.34 miles per hour. The Cygnet model is of full tetrahedral construction as in the kite Cygnet and weighs 42 lbs.

The half-sized model of drome No. 5 weighs 41 lbs. 420 observations were made; 200 of altitude, 200 of pull and 20 of wind velocity. Photographs of these kites are shown in this Bulletin.

Almost immediately after the conclusion of the experiments a squall struck both kites while they were in the air, and broke them. Mr. Bedwin took the wind velocity immediately after the accident and found it to be 39.4 miles per hour. The velocity during the squall was very much greater and may have been as high as 50 miles an hour.

In the case of the Cygnet model of full construction the keel stick was ripped out of the kite which then fell, gradually drifting with the wind, till it touched the ground. The damage can be repaired.

In the case of the Cygnet model of hollow construction the keel stick was not ripped out in the air but the kite broke its back and a considerable portion of the structure was blown away, the rest of the kite continued flying steadily and came down gradually sideways to the ground. After it landed the keel stick was ripped out by the force of the wind. The damage to the structure is much greater than in the case of the Cygnet model. The following report handed in by Mr. Bedwin gives the experiments in detail:—

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KITE EXPERIMENTS WITH CYGNET & NO.5 MODELS OCT. 31, 1908.

Cygnet Model .

Exp. 1. Wind Alt Pull 17.80 32 70 33 65 35 80 34 75 35 70 36 75 38 80 38 60 38 55 43 60 362 690 Exp. 2. Wind Alt Pull 8 60 40 55 38 60 37 50 35 35 37 70 41 55 42 50 44 55 46 50 398 540

Remarks:— Kite very steady. Good stea ? d y breeze.

No. 5 Model .

Exp. 3 Wind Alt Pull 15.20 27 65 28 50 28 50 28 55 26 55 29 60 30 55 30 65 37 80 38 65 301 600 Exp. 4 Wind Alt Pull 16.45 38 65 39 45 38 55 33 55 36 75 42 60 37 70 40 90 37 95 37 80 377 690

Cygnet Model .

Exp. 5. Wind Alt Pull 19.75 38 85 37 90 37 80 34 70 40 80 37 80 35 90 35 85 36 120 38 70 367 850 Exp. 6. Wind Alt Pull 19.60 36 90 38 110 38 120 32 125 36 120 35 110 32 115 34 110 34 110 36 110 355 1120 26

2 No. 5 Model .

Exp. 7. Wind Alt Pull 22.90 35 110 35 115 35 120 35 125 34 120 34 100 34 110 35 115 35 105 32 90 344 1110 Exp. 8 Wind Alt Pull 22.60 30 90 32 90 31 85 35 80 37 110 36 110 38 115 35 120 37 100 35 110 346 1010

Cygnet Model .

Exp. 9. Wind Alt Pull 22.75 32 150 34 140 33 160 33 140 33 150 33 130 27 125 36 140 33 140 33 110 337 1385 Exp. 10. Wind Alt Pull 22.65 34 135 38 130 35 120 34 140 34 130 34 120 35 110 37 100 35 140 36 150 352 1275

Remarks:— F B oth kites started sliding off wind to starboard. Hollow kite on lower cleat did not recover itself and came to the ground. Solid kite on upper cleat recovered itself just before coming to the ground.

No. 5 Model .

Exp. 11. Wind Alt Pull 27.20 33 170 35 160 35 150 35 170 36 170 36 135 36 140 33 150 35 170 33 170 347 1585 Exp. 12. Wind Alt Pull. 27.05 32 160 34 160 34 200 30 170 34 150 35 120 33 150 33 150 30 170 22 150 317 1580 27

Cygnet Model .

Exp. 13. Wind Alt Pull 31.00 30 200 31 175 31 200 30 210 29 220 34 180 33 190 34 190 30 225 34 200 316 1990 Exp. 14. Wind Alt Pull 30.00 34 150 31 160 30 160 30 165 32 200 30 210 31 200 29 220 30 190 30 180 307 1835

No. 5 Model .

Exp. 15. Wind Alt Pull 26.90 34 150 34 150 34 140 33 140 34 130 34 130 34 130 35 120 35 120 28 130 335 1340 Exp. 16. Wind Alt Pull 25.70 32 110 33 100 33 120 34 120 36 120 37 110 37 120 40 135 41 120 41 130 364 1185

Cygnet Model .

Exp. 17. Wind Alt Pull 25.60 33 150 30 210 30 150 28 150 29 150 35 160 33 165 32 200 30 200 28 160 308 1695 Exp. 18. Wind Alt Pull 25.20 31 170 30 200 29 210 31 160 34 140 34 150 32 150 32 140 34 130 33 160 320 1610 28

Model No.5

Exp. 19. Wind Alt Pull 26.75 34 170 33 120 33 130 32 130 33 120 34 110 32 140 33 130 35 120 36 140 335 1310 Exp. 20. Wind Alt Pull 25.50 35 120 36 130 37 140 31 140 32 150 31 180 25 170 28 220 30 180 23 170 308 1600

Remarks:— Just after the last reading there came a terrif ? i c squall and it simply ripped the flying lines right out of both kites. Hollow kite went first. Velocity of wind taken just after smash. 39.40 m p h.

SUMMARY OF EXPERIMENTS WITH CYGNET MODEL AND No. 5 MODEL, Oct. 31, 1908.

Cygnet Model .

Exp. Alt Pull Wind Obs Angle Obs lbs. Obs Miles 1 10 362 10 690 1 17.80 2 10 398 10 540 1 16.20 5 10 367 10 850 1 19.75 6 10 355 10 1120 1 19.60 9 10 337 10 1385 1 22.75 10 10 352 10 1275 1 22.65 13 10 316 10 1990 1 31.00 14 10 307 10 1835 1 30.00 17 10 308 10 1695 1 25.60 18 10 320 10 1610 1 25.20 Summation 100 3422 100 12990 10 230.55 Average 34°.22 129.90 lbs 23.055 miles

Efficiency 1.1

No. 5 Model .

Exp. Alt Pull Wind Obs Angle Obs lbs. Obs Miles 3 10 301 10 600 1 15.20 4 10 377 10 690 1 16.45 7 10 344 10 1110 1 22.90 8 10 346 10 1010 1 22.60 11 10 347 10 1585 1 27.20 12 10 317 10 1580 1 27.05 15 10 335 10 1340 1 26.90 16 10 364 10 1185 1 25.70 19 10 335 10 1310 1 26.75 20 10 308 10 1600 1 25.50 Summation 100 3374 100 12010 10 236.25 Average 33°.74 120.10 lbs 23.625 miles

Efficiency 1.1

In all the above experiments the kite was flown by a one-quarter inch manilla rope, 100 m long attached at the front edge of the kite structure (+ 100 cm).

The Cygnet model weighed 42 lbs or 19068 gms and contained 984 winged cells having a total silk surface of 53.2590 sq m. Ratio 358 gms per sq m.

The model of No. 5 weighed 41 lbs, or 18614 gms and contained 630 winged cells having a total silk surface of 34.0987 sq m. Ration 546 gms per sq m. G.H.B.

(approved A.G.B.).

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EXPERIMENTS WITH KITES.

Beinn Bhreagh Nov. 6, 1908 :— Experiments were made this morning with the white Oionos kite which forms the model for the aerial super-structure of drome No. 6. (see bulletin XIII p. 25).

It was expected that the kite would be subject to longitudinal oscillations without a steadying tail, and so a tail was provided. It was unfortunately decided to try it first without the tail.

Exp. 1. The kite without any tail was raised by a bow-line in a strong and stormy wind. Longitudinal oscillations took place. The sudden changes of tension snapped the line, and the kite was broken coming down. The sudden termination of this experiment is greatly to be regretted as it had been hoped to obtain data that would have a bearing upon the behavior of drome No. 6 in the air. This kite was the most finished structure yet produced at Beinn Bhreagh. The damage is considerable, and it will probably pay better to construct-another kite upon the same model made in a rough and ready way rather than take the time to repair this kite excepting as a model.

Exp. 2. Pilot kite flown by stout line from point 37.5 cm.

32 Exp. 2 Wind Alt Pull 10.95 46 15 48 19 52 18 46 15 47 32 49 8 48 16 47 24 47 5 49 24 Summation 479° 176 lbs. Average 47°.9 17.6 lbs.

Exp. 3. Pilot kite flown by stout line from point 50 cm.

Exp. 3. Wind Alt Pull 13.05 43 16 40 16 39 17 46 18 38 23 37 19 43 8 31 24 40 8 43 10 Summation 400° 155 lbs. Average 40°.0 15.5 lbs.

Exp. 4. Old red Oionos kite tried on bow-line would not fly.

Exp. 5. Old red oionos kite flown by stout line attached to point 50 cm. Wind 10.06 miles per hour. Flew away off wind and had to be brought down. Examination showed that kite structure was slightly twisted.

Exp. 6. The kite structure was straightened out by hand and the old red Oionos kite was tried again by stout line attached 25 cm. Wind 10.75 mph. Flew well and was raised by line more than 300 m long. Alt. and pull not measured. G.H.B.

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48 Taken 1908 Oct 24 th New 1908 Oct 24

34

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BALDWIN'S EXPERIMENTS WITH THE DHONNAS BEAG.

Beinn Bhreagh, Nov. 3, 1908 :— Dhonnas Beag was tried to-day with an aerial rudder 3 ft sq., which acts when the hydro-rudder comes out of water. Both rudders are operated on the same rudder post. Boat steered very well both in and out of water. The hayrakes were not used in this experiment as they bent too much on former occasions. It was plainly seen that some sort of steadier from port to starboard is needed, as boat lurches over on her side when she rises. G.H.B.

Beinn Bhreagh, Nov. 5, 1908 :— Tried Dhonnas Beag under her own motive power using hayrakes to steady her.

100 m in 26 sec down

100 m in 25 ½ sec up

200 m in 57 ½ sec.

Dhonnas Beag went hard aground on making the turn at the lower end of course.

Mr. Baldwin is not satisfied with the action of the hayrakes. They seem to manifest a tendency to twist the trusses submerging the outrigger floats bow downwards. G.H.B.

Beinn Bhreagh, Nov. 7, 1908 :— Two sets of reefing hydro-surfaces (hydro-curves not hydroplanes) have been completed. (See photographs in this Bulletin).

When the Dhonnas Beag lifts clear of the water and begins to speed up on her hydro-surfaces, the larger surfaces will first come out of water so that as she rises there will 36 37 38 2 be less and less submerged surfaces to be propelled through the water. The lowest surfaces are the smallest.

Mr. Baldwin proposes to use three sets; two very slightly behind the center of gravity, and one very far forward. Only two were ready for trial to-day. These were arranged on either side of the boat about midships, and one of the sets shown in Bulletin XVIII p. 30 was used in front. All of these hydro-surfaces have cutting edges. That is, they are V shaped in plan. The angle of the V in the forward set (Bulletin XVIII p. 30) was very obtuse. On the new sets the angle is very much smaller.

Exp. 1. Mr. Baldwin took the Dhonnas Beag down the course under her own power. She developed good speed (not measured) coming clear of the water on her hydro-surfaces and keeping on an even keel. On the way down a water-logged piece of wood of considerable size was encountered. The collision distorted the forward set of hydro-surfaces badly and the log showed marks of the cutting edges by lines cut as though with a knife. After encountering the forward hydro-surfaces the log was caught by one of the rear sets and held. These hydro-surfaces were uninjured.

Exp. 2. The boat was then towed back to the shed, and the front hydro-surfaces were straightened out and then put back. It was found during this experiment that the resistance was very great when the boat did not rise out of the water, probably on account of the aluminum framework above the new hydro-surfaces.

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3 Exp. 3. A horizontal aluminum strut was removed on either side and the resistance of the boat was considerably reduced. G.H.B.

Beinn Bhreagh, Nov. 10, 1908 :— The Dhonnas Beag was tried to-day with same outfit as used Nov. 7, Exp. 3. In the first four experiments and the last, she was propelled by her own motive power, while in the rest of the days experiments she was towed by the "Skidoo", the engine and plant still being on board.

Exp. 1. Got only half-way down course when engine had to be stopped and boat towed back to shed.

Exp. 2. One hundred meters in 25 seconds up.

Exp. 3. One hundred meters in 20 seconds down. Boat came out of water about six inches.

Exp. 4. One hundred meters in 26 seconds up. Boat did not come out of water.

Exp. 5. Dhonnas Beag was then towed by "Skidoo" with Bedwin on board in order to ascertain pull, which was found to be 75 lbs.

Exp. 6. Without anyone on board. Pull 55 lbs. Boat did not lift clear in either case. Time 100 meters in 30 sec.

Exp. 7. Dhonnas Beag was again towed with man on board. 100 meters in 32 sec down. Pull 50 lbs. Boat did not lift out of water.

Exp. 8. Half-way up course Bedwin got aboard Dhonnas Beag and her engine was started up, running her back under her 40 4 own motive power. Boat did not clear herself. G.H.B.

Beinn Bhreagh, Nov. 13, 1908 :— Mr. Baldwin reports an experiment to-day with the Dhonnas Beag without any hydro-surfaces at all. Curtiss No.2 engine was used with a four-bladed propeller 2 meters in diameter, 30° at the tip, gearing 3:1, giving a push of about 105 lbs. The propeller was driven indirectly. The Dhonnas Beag made 100 m in 12 seconds. This is 30 kilometers (or 18 ½ miles) per hour. G.H.B.

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Charles J. Bell to Bell .

To A. G. Bell, Baddeck, N.S.

Washington, D.C., Nov. 2, 1908 :— I will take up the matter of the administration of the estate of Lieut. Selfridge with his father, to whom I will write to-day.***

I am reading the weekly Bulletins with a good deal of interest and am anxious to hear the results of the experiments at Hammondsport.

(Signed) C.J. Bell.

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Chanute To Bell .

To Dr. A.G. Bell, Baddeck, N.S.

Chicago, Ill. Oct. 13, 1908 :— Three days of diligent search among my numerous clippings have failed to find those from which I drew up the account of the Copenhagen experiments on screws; but, fortunately H.C. Vogt is still there and gives his address in a letter to London "Engineering", which I enclose herewith. I also enclose his paper on the "Air Propeller" which was published in the proceedings of the Conference on Aerial Navigation in 1893. Please accept it. I have a letter from St. Petersburg, Sept. 14, 1908, stating that Col. Ochtchewny Krouglin has discovered a new form of screw propeller with stiff front edge and thin rear edge, concaved on the under side 1/12 of width and of parabolic section, which is said to give results twenty times greater than flat bladed screws, at a speed of 400 meters per second. I have sent for more particulars. At my suggestion Merrill of Boston made some experiments of this form some years ago, but got no such results.

(Signed) O. Chanute. (Note:— Mr. H.C. Vogt's address is, 108 Osterbrogade, Copenhagen. A.G.B.).

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A TRIBUTE TO SELFRIDGE.

“With the tragic fate that befell Lieut. Thomas E. Selfridge, there has been lost to use one of the noblest of young men. A man in the prime and flower of youth, he stood poised upon the threshold of fame, and in the very instrument that would have won him this fame he met his death. A most glorious cause we say, one that would serve his country in time of war; but that does not reconcile us to his end that came only too soon. Beloved by all who knew him, by his brother officers and hi ? s men, a devoted son, a good brother and a most loyal, true friend. His loss will be felt by all of those who had the privlege to know him and even by those who knew him only be reputation, for he had endeared himself to all by his manly conduct. He was one of those

Strong men ranged on High Who did his work, who held his peace And had no fear to die”.

(From Town Talk, Tha Pacific Weekly, San Francisco, Oct. 3, 1908).

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THE OUTLOOK ON AVIATION: By Gardiner H. Bell.

Items Gleaned from the Newspapers .

Mr. Lesh, who was towed over the St. Lawrence last year in a gliding machine flown as a kite, made an exhibition at Morris Park with a new glider having concavo-convex surfaces. The machine was raised into the air by being towed by a motor car. The towing rope was then let go and Mr. Lesh attempted to glide to the ground. He made two or three successful flights and then fell from a height of 50 ft. and broke his leg.

Another unfortunate accident occurred at Morris Park when the “Wind Wagon” of Dr. Thomas, driven by an aerial propeller was overturned in trying to avoid a motor cycle, and Dr. Thomas was injured.

The Kimball helicopter, also exhibited there, failed to work.

It may be interesting to note that a monument is to be erected for Henri Farman at the place of his landing at Rheims in commemoration of the first cross-country flight on record of a heavier-than-air machine from Mourmelon to Rheims, a distance of 20 miles.

The newspapers report the appearance of a new journal “The Airship” in England. It is interesting to note that the American Navy is looking into aeronautical matters in view of using heavier-than-air machines to reconnoitre in time of warfare. It is reported they have called for bids.

It is reported that the interest in the subject of aeronautics among the students of Columbia University has 45 2 been so much aroused that the students have organized an Aero Club.

The Aero Club of America is reported to have ordered one of the Wright machines for the use of the members and have acquired a tract of land of several hundred acres to be used as a Park for aeronautical experiments. The Club proposes to erect a gas plant there for balloons and place the Park at the disposal of the members for experiments with both balloons and heavier-than-air flying machines.

Wilbur Wright had a slight accident at Le Mans at the take off of the starting apparatus when the vertical rudder dragged on the ground and was disabled.

It seems that Herring wants the Government to give him another extension of time.

Prof. Zerbe of Los Angeles, California has an aeroplane with 12 sustaining surfaces arranged in separately moveable groups. The idea of the machine is slow s f light.

L'Aerophile for November 1908 :— L'Aerophile for November 1908 contains a translation from the Wright Brothers article in the Century Magazine for September. Pages 428–429 gives a record of the flights of Wilbur Wright from Sept. 16, to October 15 with the names of the passengers carried.

Page 429 contains a note concerning the aeronautical course at Columbia University.

Aviation, Pages 434–437 :— In France.

Goupy's aeroplane.

M. Gabriel Voisin : Made successful flight Oct. 19, at 60 kilometers per hour. A new propeller was used having 46 less diameter and greater pitch than the one formerly employed.

Gasnier :— Photograph of Gasnier machine in the air taken Sept. 17 just before its destruction.

Bleriot :— Oct. 9 made several flights with his monoplane “The Antoinette”. On Oct. 21 a flight of 7 kilometers was made against a violent wind in six minutes and forty seconds at the height of 20 meters. On Oct. 22 he made another flight against a still stronger wind; but the motor suddenly stopped in the air, and the machine made a bad fall after a flight of 550 meters in 30 seconds.

In his flight of Oct. 9 the Antoinette which was constructed upon the model of the old Gastambide-Mengin raised itself easily from the ground and flew a considerable distance when the oil feed became disconnected and the oil caught fire. The aviator however, experienced more fear than damage. With great presence of mind he shut off the oil and came down. The landing was less hard than expected; one wheel was broken. The experiments Oct. 22 also ended badly a beam was broken on landing which obliged the intrepid aviator to postpone further experiments.

Esnault-Peltrie :— He has completed his new aerodrome Rep. No.2 bis, a photograph of which is shown on page 435.

Santos Dumont :— He continues to show an interest in Aviation and is constructing a new aeroplane which is a copy of the Demoiselle with which he experimented at Issy-les-Moulineaux.

Detable :—is going to try a monoplane having a surface of six square meters furnished with a motor of 2 ½ horse power weighing 8 kilograms complete in working order. 47 There is nothing new about the aeroplane but it is automatically stable without tail or “equilibreur”.

Hervieux :— M. Leon Hervieux, a native of Havre is at work upon a monoplane. The apparatus has a width of 10 meters It is furnished with a motor of from 18 to 24 horse power, and will weigh only 100 kilos. He hopes to commence his experiments in a few days.

Hughes :— MM. George and Rene Hughes have constructed a tri-plane aeroplane, which they have actually tried on the plains of Coubillion. It has a surface of 32 sq. m. The propeller is 1.5 meters in diameter; weight 83 kilos; width is only six meters and length 7.45 meters; with a ten horse power engine they expect to leave the ground at a speed of 36 kilometers per hour.

French Military Aeroplane: — France possesses, constructed and ready to fly a military aeroplane. It is at the military Camp Satory under the vigilant guard of soldiers of the Artillery and Engineers. Its form is that of a tri-plane. The propeller is placed in front of the aviator's seat. The first experiment was made Oct. 20.

Foreign Countries :— First experiments of “de Caters” the Baron de Caters commenced on the 17th of Oct. at Sgravenwezel experiments with his tri * - plane. The machines seems to have been tried upon the ground and no attempt was made to rise into the air.

Flight of the English Military Aeroplane :— After several weeks of almost daily experiments at the camp at Aldershot the aeroplane Tonilea constructed for the War Office under the orders of its inventor, Col. Cody appeared 48 absolutely at fault. On the 15th of Oct. the resolute aviator attempted at last his first flight. After having run along the ground for some meters the apparatus lifted itself and perfect in stability flew about 3 or 4 meters above the ground, a distance of about 500 meters in a ? s traight line. But Col. Cody in order to avoid a clump of trees tried to turn too quickly and the aeroplane lost its balance and fell heavily. The aeroplane has been completely destroyed. Col. Cody escaped uninjured. Photograph of the English Military aeroplane is given on Page 436.

Parseval :— Major von Parseval has constructed several models of aeroplanes some of which follow the monoplane type like Bleriot'sThe Society for the study of aerial navigation by motive power will soon make experiments with these aeroplanes. This Society is also occupying itself with an aeroplane invented by Prof. Prandt of Gottingen.

The town of Brescia has organized for September 1909 a “Concour International d'Aviation”. About the same date at Bologne there will take place a “concour d'aeroplane”. The aviators will find it possible to attend both Italian meetings (Milan and Brescia). G.H.B.

BULLETINS OF THE Aerial Experiment Association

Bulletin No. XXI Issued MONDAY, NOV. 30, 1908

ASSOCIATION'S COPY.

BEINN BHREAGH, NEAR BADDECK, NOVA SCOTIA

BULLETIN STAFF

Alexander Graham Bell Editor

Gardiner H. Bell Assistant Editor

Charles R. Cox Typewriter

Mabel B. Mccurdy Stenographer

Bulletins of the Aerial Experiment Association .

BULLETIN NO.XXI ISSUED MONDAY NOV. 30, 1908.

Beinn Bhreagh, Near Baddeck, Nova Scotia .

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AERODROME NO.4, McCURDY'S SILVER-DART: By J.A.D. McCurdy.

Upon receipt of the following telegram from our Chairman on July 6th, designs were immediately got out preparatory to building the new A.E.A. No.4:—

To The Aerial Experiment Association, Hammondsport, N.Y.

Pictou, N.S., July 6, 1908: —

If McCurdy wishes to follow on line of “June Bug”, I recommend that McCurdy's machine be now built at Hammondsport and headquarters be retained there for the present. In meantime don't run any risk of injuring “June Bug” until an application for a patent has been prepared. Would like Baldwin to help me in Baddeck soon as possible, and when we are ready for motor would like all to come to Baddeck. If these plans are acceptable would simply let it be known that at my request further trials of “June Bug” will be postponed until another aerodrome has been completed so that in case of accident to one machine another will be available for experiments. Would say nothing about patents outside as this would only stir up other inventors to forestall us in the patent office. Telegraph reply to Baddeck.

(Signed) Graham Bell.

Experiments with the June Bug seemed to indicate that more powerful tip controls would be an advantage, (Fig. 1) especially in attempting to complete a turn and possibly describing a circle. To accomplish this end we gave the machine greater lateral extension than in the case of either of the former machines, (49 ft.) and also increased the area of the tip controls themselves, (40 sq. ft. total area). Although it was conceded that a plane having the form of the letter S (roughly) in cross section was the form having the greatest efficiency, as demonstrated by W.R. Turnbull of New Brunswick, 2 we came to the conclusion that if a rib was formed up being of single curvature, it would take the form of the Turnbull curve when acted upon by the air pressure as the machine glided through the air, if the rear was unrestricted and flexible, but if the rib was moulded with the double curve form the air pressure would bend it up abnormally at the rear and hence produce a detrimental effect.

We, therefore, decided to make up our ribs for the “Silver-Dart” (as A.E.A. No.4 was afterwards named), having the single curvature form (Fig.2). The depth of the planes was reduced at the center from 6ft. 6 inches to 6 ft., and the distance between the planes consequently reduced in the same ratio, (6 ft. 6 inches to 6 ft).

We designed the ends of the supporting planes to have a depth of 4 ft. as in former cases, and also to be 4 ft. apart. This re-proportioning gave the lateral curve of the back edges an evener form and the machine as a whole finer lines (Fig. 3 & 4).

The fish-shaped material used all through is of heavier stock and hence capable of greater rigidity of structure.

Turnbuckles, (Fig. 5 shows fastening at top and Fig. 6 that at bottom) are used on each individual wire, so that they can be separately adjusted to receive their proper strain. Two special instruments were devised; one as a tool for constructing the turnbuckle and the other a wrench to facilitate the screwing up of these turnbuckles. (Fig. 7 & 8).

3

The sockets used to connect the struts to the lateral chords are in their simplest form, doing away with the jack joint used on the “June Bug”. The projecting spike at the end of the socket passes through the straps to which the guy wires are secured and then into hole prepared in the socket connecting the sections of the lateral chords. (Fig. 9 & 10).

The tightening up of the turnbuckles of the guy wires prevents these spikes from coming out. A single wire passing through the middle of the struts and connected by a V wire to both the top and bottom chord at the lateral extremities of the machine seems to answer the purpose of steadying the struts better than two wires, as in former cases, and it also offers less head resistance. (see Fig. 1).

The cloth used to cover the ribs, etc., forming the supporting surface is similar to that used by Capt. T.S. Baldwin for his Government balloons, although lighter in weight, (2 ounces per sq. yard) and having silk on only one side of the rubber coating. It forms a beautiful surface, rubber side down, and is easy to handle, and capable of being cemented, as ordinary rubber. The tip controls were covered by making the silk in the form of a triangular bag and drawing it on tightly over the frames thus making an equally clean surface on the top and bottom. As in the case of the June Bug, a steel tube rib is placed at the junction of each section and acts as a spreader for the lateral chords. (Fig. 11, 12, 13, & 14).

The central panel is made exceptionally strong for various reasons. The bending moments are greatest there and 4 also as the dead load is located at that point the racking strains tell more there than elsewhere. This panel is made up first and is complete in itself. The four wings when placed in position fit into projecting sockets from each side of this panel, and are secured in place by the same method employed throughout the structure, viz. of attaching and tightening up the turnbuckles. Thus the four wings can be readily removed without disturbing the central panel, engine-bed, propeller or running gear. Figs. 15, 16, 17 & 18 show the various points of construction of this panel.

The silk of the “Silver-Dart” is made in sections corresponding to the panel where it is to be used, and laces to a steel rib at each end. Thus the whole machine, silk and all, is made in sections so as to facilitate in repair work, should we be unfortunate enough to have an accident. The advantage of having silk in sections in “knocking down” the machine is also apparent. The ribs slide into pockets prepared on the silk, from the rear passing under the back lateral chord and butting neatly against the back edge of the front chord and are secured in place by square tin caps, which slip over the rear end. These caps, one for each, and are strung on a wire which passes through a seam in the rear of the silk and is secured at its ends to the lateral margin of the aeroplane, and to the central panel, being drawn taut by means of a turnbuckle. There are two of these wires to a plane, one for the port wing and one for the starboard.

The rudder used on the “Silver-Dart” is of quite small dimensions (4ft. high by 2 ft. deep) and is constructed, as far as the silk is concerned, similarly to the tip controls, 5 i.e. covering made as a bag and drawn on over the framework and laced at the top. As both sides of the rudder act at different times, this method gives them even resistances. The rudder is placed 11 feet back from the rear lateral chord, and is supported simply by four hinged bamboos so constructed that by releasing two lateral guy wires the whole thing folds up flat against the rear of the planes. The rudder is operated by small wire cable connected to the tiller of the front wheel (fig. 19). The bow control is double-decked, rigidly constructed throughout and placed 15 feet forward of the front lateral chord. It is operated similarly to that used in the “ ? J une Bug”, by a direct bamboo rod at the rear end of which is the steering wheel. Push the wheel forward, it depresses the machine; pull it back and the machine rises; turn it to port or starboard, and the machine obeys respectively, whether on the ground or in the air.

The front control measures 12 feet long by 28 inches wide and 30 inches between the planes. It is supported five inches back from its front edge by a bamboo cantilever truss as shown by Fig. 4.

It was our original intention ? t o carry two persons in the “Silver-Dart”, one sitting directly behind the other; hence a seat was designed for the purpose and made adjustable so that it could be slipped forward and backward readily in balancing up the machine. The second man would sit directly over the theoretical center of pressure at our traveling speed, so that the carrying of the passenger on leaving him behind would not affect the balance. The tips are controlled 6 by a device which does not interfere with the man sitting behind the operator, and the device is also adjustable with the seat. (Fig. 3).

The pole connecting the steering wheel to the front control can be lengthened out or shortened in determining where the operator shall sit, by means of a telescopic tube which can be secured at any desired point.

The running gear or truck is almost the same as that used in the “June Bug”. There are improvements of construction and the material is heavier. (Fig. 20).

The engine used was especially built for the “Silver Dart” and is a Curtiss eight cylinder, water-cooled 50 H.P. motor, (see Bulletin XVI) which weighs without water or oil, but including all water connections and counter-shaft 202 lbs. It is placed with its bed immediately on top of the lower rear lateral chord, and braced directly from the stringers of the truck (see Fig. 3 & 4). Its being placed so low will produce less strain on the structure in landing and will bring the center of gravity of the machine, as a whole, a little lower than in the case of the “June Bug”.

The radiator is designed somewhat after that used by the Wright Brothers, (see Fig. 4) and the gasoline and oil tank (one tank having a partition) holds 10 and 2 gallons, respectively.

The propellers used are of different designs and are driven by a chain drive in the ratio of 1-½ to 1. (Engine turning 1500 revolutions and the propeller turning 1000). 7 One propeller is used, and the thrust comes about through the line of resistance of the machine, but inclined above the horizontal 3 ¼ degrees. These are made of laminated wood and weigh, including the two clamps, 8 ½ lbs; of 8 ft. diameter and 17 to 18 degrees pitch at the tip.

The supporting surfaces of the machine are given an angle of attack of 9 ¼ degrees at their lateral margins. This angle is excessive for economical flights, but it facilitates rising from the ground. After the machine is in the air, the angle will be reduced to perhaps 6 degrees.

It is for this reason that the propeller thrust is a little above the horizontal when the machine is on the ground. The proper angle at which to place the counter-shaft for propeller can only be determined by actual experiment.

The actual work of construction of the “Silver-Dart” was under the supervision of our foreman, Mr. Kenneth Ingraham and too much cannot be said in his praise for the care taken by him in the detail work and in generally rushing the assembling to a successful finish.

All the structural members of the "Silver-Dart", fish struts, wires, tubing, bamboo etc., were carefully measured and in accordance with the method and co-efficients used by Mr. Octave Chanute the head resistance of the machine was computed and reduced to its equivalent flat surface in square feet. All figures in square inches.

8 FISH-SHAPED MATERIAL NON VIBRATING WIRE VIBRATING WIRE. Wings 1928.5 976.89 131.30 Struts 1088.0 Additional fish 326.0 3342.5 TUBING TIMBER BAMBOO 668.00 365.5 345.0 DESCRIPTION SQ. INCHES CO-EFF. EQUIV. SURFACE Fish-shaped 3342.50 # 557.08 Non Vib Wire 976.89 ½ 488.44 Vib Wire 131.30 1.5 198.95 Tubing 668.00 ½ 334.00 Timber 365.50 1 365.50 Bamboo 490.00 ½ 245.00 Total 2188.47

Hence the total head re i s istance, 2188.47 sq. inches, or 15.19 sq. ft.

DATA .

Total area of supporting surfaces 420 sq. ft.

Weight of machine, exclusive of engine and accessories 345 lbs

Weight of engine, propeller and counter-shaft etc. 210 lbs

Weight of radiator 15 lbs

Weight of water 30 lbs

Weight of gasoline, oil and tank, full 110 lbs

Weight of man, say 150 lbs

Total 860 lbs

and as 860 420 = 2.04. Hence ratio equals 2.04 lbs. per sq. ft.

i.e., flying weight = 2.04 lbs. per sq. ft.

J.A.D. McC.

Fig. 1 LEFT WING OF GLIDER IN PERSPECTIVE, SHOWING WIRE SUPPORTS AND STEEL RIBS IN POSITION. NO SCALE.

SHOWING DECREASE IN CURVATURE OF STEEL TUBING RIBS. Scale — 2 inches = 1 ft.

11

FiG. 3 PLAN.

12 20811-B

Fig. 4 SILVER DART. Scale-½=1 ft.

22 GAUGE BAND IRON CABLE TERMINAL, LARGE SIZE. FULL SIZE.

22 GAUGE BAND IRON CABLE TERMINAL SMALL SIZE FULL SIZE.

LARGE TURN BUCKLE OF 22 GAUGE SHEET IRON WITH BRACE ATTACHED. FULL SIZE.

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Fig. 7 TOOLS FOR MAKING EYE-SCREWS IN TURN BUCKLES FULL SIZE.

NICKLE PLATED TURN BUCKLE ADJUSTER FULL SIZE.

GAUGE SHEET IRON FOR LARGEST STRUT. FULL SIZE.

GAUGE SHEET IRON SOCKET FOR SMALL STRUT. FULL SIZE.

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Fig. 11 TERMINALS ON FRONT AND REAR STRUT, 1 ST PANEL FORM CENTRE FULL SIZE.

20

Fig. 12 FULL SIZE.

STEEL RIB SMALL SIZE SOCKET OF 22 GAUGE SHEET IRON USED AT 2 ND . & 3 RD . PANEL FROM CENTRE. FULL SIZE.

22

Fig. 14 BOTTOM OF STRUTS USED AT 1 ST PANEL FROM CENTRE, SHOWING CORD AND TURN BUCKLES IN POSITION. FULL SIZE.

17 GAUGE SHEET IRON STRUT END FASTENER AT LOWER CENTRE PANEL. FULL SIZE.

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Fig. 16 STRUT END FASTENER AT CENTRE PANEL IN POSITION. FULL SIZE.

22 GAUGE SHEET IRON CORD SOCKET FOR LOWER CENTRE PANEL. FULL SIZE.

26

Fig. 18 STEEL TUBING RIBS AND 22 GAUGE SHEET IRON SOCKETS USED AT TOP RIGHT AND LEFT SIDE OF CENTRE PANEL.

29 GALVANIZED CORD 1/16;“ DIA, LINNEN CENTRE. USED AS STEERING CABLE ETC. ENLARGED 4 TIMES0.

Fig. 20 TRUCK AND RUNNING GEAR USED ON SILVER DART SHOWING ¾ “ STEEL TUBING AND WIRE CABLE BRACINGS.

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INGRAHAM'S FOLDING TAIL: By J.A.D. McCurdy.

Although we have in our experiments with the “Red Wing,” “White Wing”, and “June Bug” gone through the stage of using a horizontal tail on Chanute type aerodrome, it may be as well to place on record some account of the folding tail used on the “June Bug”.

The following diagrams show pretty well how, by the letting go of a few guy wires which brace the tail to the main planes, the bamboo sticks forming the tail, supporting lines, double up on themselves and allow the box tail to fold right in against the rear of the main planes.

This was found to be of great advantage in housing the machine as the size of tent required, especially in the lateral dimension, was considerably reduced.

The idea of folding was thought of an worked out by Mr. Ingraham.

J.A.D. McC

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BULLETINS OF THE Aerial Experiment Association

Bulletin No. XXII Issued Monday Dec. 7 1908.

Association Copy

BEINN BHREAGH, NEAR BADDECK, NOVA SCOTIA

BULLETIN STAFF.

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Bulletins of the Aerial Experiment Association .

BULLETIN NO.XXII ISSUED MONDAY DEC. 7, 1908

Beinn Bhreagh, Near Baddeck, Nova Scotia.

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12.The framework for the new boat now being built to accommodate the Hammondsport engine. This boat is to be the successor of the Dhonnas Beag. (lower) 31

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EDITORIAL NOTES AND COMMENTS .

Baldwin's Experiments.

Nov. 20, 1908: — A conference was held in the headquarters building this afternoon to consider the general results obtained with hydro-surfaces on the Dhonnas Beag.

The best results so far as efficiency is concerned were obtained in experiments made October 28, 1908, in towing experiments, when the lift was 12.9 times the pull (see Bulletin XVIII p.29). The later arrangements of hydro-surfaces have not proved to be so good. It was therefore determined to use again the arrangement of hydro-surfaces used on Oct. 28 and multiply observations. Should the average result again yield an efficiency exceeding 10 we will accept this arrangement of hydroplanes as satisfactory and develop other points. It is not our object at the present time to get the best possible form and arrangement of hydro-surfaces. We might spend our whole lives upon this point and our descendants would still improve upon our results. Let us be satisfied with an arrangement that works and then leave alone the question of the character of the hydro-surfaces to be employed and consider other points. The most important being a satisfactory arrangement to secure stability when the boat rises from the water.

The stability seemed to be good when three sets of the reefing hydro-surfaces shown in Bulletin No.XX p.37 were used, but I find no record of the experiments which were 2 probably made between Nov. 10 and 13. The stability was good and the lift poor, whereas in experiments made Oct. 28 the stability was poor and the lift good.

Let us then try the hydro-surfaces used Oct. 28 with the arrangement of reefing surfaces which gave good stability Of course the question of stability will be more easily met when the center of gravity is brought lower down by placing the engine and man inside the boat instead of above it.

In the meantime it is obvious that the general principle involved is to secure in the water an extended base of support. This suggests three sets of hydro-surfaces well separated from one another forming the corner of a triangular base of support. A.G.B.

November 27, 1908: — The experiments made Nov. 23 have demonstrated the superior efficiency of the hydro-surfaces employed Oct. 28 (Bulletin XVIII, p.30) and in order to improve the stability it was proposed to use three sets of such surfaces instead of two, the two rear sets to be placed one on each side of the boat. Practical difficulties, however, present themselves in making this arrangement and before doing so it has been decided to test what element in the combination shown Bulletin XVIII, p.30, produces the great efficiency.

There are three points involved.(1) The surfaces do not present a straight edge at right angles to the line of advance, but are bent backwards so as to form a blunt V, presenting cutting edges. (2) The supports are not vertical but are sloped backwards. (3) The surfaces are not flat but curved 3 from fore to aft.

Mr. Baldwin thinks that the most convenient shape for the proposed arrangement of three sets would be to have the surfaces present a straight edge at right angles to the line of advance and to have the supports vertical. A set of hydro-surfaces has now been made of this character in which the surfaces are curved from fore to aft. Another similar set has been made with flat surfaces. A comparison of the results of these two will show whether there is any advantage in using curved surfaces over flat.

If the curved surfaces do not give us the efficiency of the surfaces shown in Bulletin XVIII, p.30, then we must conclude that the good efficiency of the latter was due either to the cutting edges, or to the sloped back supports; and another set of straight edged curved surfaces will have to be made with sloped back supports to bring out the point. We wish to test the relative efficiencies of combinations differing in only one element. A.G.B.

November 28, 1908 :— Experiments made this morning with the surfaces presenting a straight edge at right angles to the line of advance and with the supports vertical. The efficiency turns out to be quite as great as with hydro-surfaces employed Oct. 28 (Bulletin XVIII, p.30). Indeed in the first experiment it was greater, 14.55. In experiment 3, 12.88; experiment 4, 11.17.

The following points seem to have been demonstrated. The good results of the old curved cutting-edged hydro-surfaces seem not to have been due to the wedge shaped form of 4 construction, for the straight edged form used to-day did as well or better. Nor were they due to the raking back of the supports, for the supports were vertical to-day and gave at least as good results.

The single point remain s i ng now to be demonstrated is whether the curvature of the blades used Oct. 28, Bulletin XVIII, p.30, was the cause of their superior efficiency. The arrangement used to-day had curved blades and we have a duplicate set with flat blades. The next experiments will show whether a hydro-curve is or is not superior to a hydroplane. A.G.B.

December 1, 1908: — The experiments with flat blades made this morning gave an efficiency of only 5.6, whereas the efficiency of the hydro-curves used Nov. 28 were 14.55, 12.88, and 11.17. The evidence indicates that the hydro-curves are more efficient than the hydroplanes.

In order to be perfectly sure of the result another experiment with the hydro-curves was made this afternoon. Efficiencies 10.51, 13.22.

It has therefore been satisfactorily demonstrated that the great efficiency of the hydro-surfaces used Oct. 28, Bulletin XVIII, p.30, was due to the curvature of the blades and not to the sloping back of the supports or to the cutting edges.

It has also been demonstrated that three sets of hydro-surfaces so arranged as to form a triangular base of support are quite satisfactory so far as stability goes. It is noteworthy that in the last experiments made, the two sets, well 5 separated laterally were in front instead of behind.

HAMMONDSPORT EXPERIMENTS.

December 3, 1908 :— Mr. Curtiss seems to be still bravely struggling with the difficulties of the new engine. He has been meeting with encouraging successes and exasperating delays, but it is obvious that as a result we are going to have finally an engine that will be worth something to the art of Aviation. An engine that will not break down in five or ten minutes and leave the aviator stranded — where!!!

He is apparently finding out the weak points of every part of the apparatus in turn; and at last when every difficulty seems to have been conquered and the engine is installed upon the Loon the c-c-c— cylinder blows its head off into the air.

We can all understand and sympathize with these mishaps. The only criticism I have to offer is that our Hammondsport members seem inclined to report only their successes, and look upon accidents as failures instead of experiences to be profited by. What we want to know from Hammondsport is the answer to the question “What are you doing”.

We want to know what you are doing. We want to know your experiences in full. Silence does not give us any information. A report of a success does not give us the opportunity of helping. Everything should be reported as it occurs with the double object of recording what happens and giving the distant members a chance to co-operate in the development of what is going on and the correction of defects.

6

The delay in completing the new engine affects us all for it is needed at Beinn Bhreagh as much as at Hammondsport. We all have confidence in Curtiss, however, and feel sure that out of his troubles will come triumph and a better and more reliable engine than we have ever had before. Go ahead Curtiss and don't get too blue. Your letter of Nov. 24 sounds like a wail. Baldwin has had his ups and downs too, but he is on top to-day — so will you be too. Go ahead and good luck to you. A.G.B.

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HAMMONDSPORT WORK : Telegrams from Members .

Curtiss to Bell .

Hammondsport, N.Y., Nov. 22, 1908 :— Experiments delayed by cylinder breaking and other insignificant though exasperating troubles. Am writing.

(Signed) G.H. Curtiss.

McCurdy to Bell .

Hammondsport, N.Y., Nov. 28, 1908: — Loon made two miles with and against five mile wind in four minutes twenty-six seconds Lift very marked, but not sufficient to take the air. Engine and transmission fine. Will install in Silver-Dart to-morrow and have first trial.

(Signed) J.A.D. McCurdy.

McCurdy to Bell .

Hammondsport, N.Y. Nov. 29, 1908 :— Tried Loon this afternoon. Made speed calculated at 20 miles an hour. Boats lifted considerably but propeller shaft sheared before Loon took to the air. An early trial to-morrow will decide the question.

(Signed) J.A.D. McCurdy.

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LETTERS FROM MEMBERS .

To A. G. Bell, Baddeck, N.S.

Hammondsport, N.Y., Nov. 17, 1908 :— I enclose a clipping which strikes me as very humorous; it is certainly not very flattering to Mr. Baldwin or any of us, and the part about making flights between five o'clock and sum down on summer evenings is not so much of a joke after all. Just now we miss those calms very much. We have been ready several times but haven't had anywhere near a calm in the last ten days.

Both machines are all ready and we are waiting for an opportunity to show what we can do. We have some new methods for attaching the propellers. With our more powerful engine and bigger propellers the old methods proved inadequate. We have also made a solid aluminum propeller cast of a soft alloy, and while it is somewhat heavier than wood, it will take the place of a balance wheel. We shall try it out on the 30 H.P. eight cylinder we are just finishing.

Capt. Baldwin is now with us having finished exhibition work for the season. He expects to build an airship for the Glidden Syndicate before Spring.

(Signed) G.H. Curtiss.

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Curtiss to Dr. and Mrs. Bell .

To Dr. and Mrs. Bell, Baddeck, N.S.

Hammondsport, N.Y., Nov. 24, 1908 :— I got somewhat discouraged Sunday and wired you about our troubles. I have not written before as we had nothing good to report. Most people don't like excuses.

On November 19 we had the “Loon” in the water and ready to start, as shown by enclosed print. The part extending through the surface above is the radiator. Everything was fine until just about to give the word “go” when a cylinder blew off. It was a flaw in the casting. I was in a boat with the big camera to get a good picture of her under way. I snapped this just after the accident happened. The cylinder may be seen out of place. The other picture shows the disheartened crowd pushing the “Loon” back to the shed. It is mounted on a two wheel cart made especially for it.

An interesting fact in connection with these experiments is that the boats are covered with rubber cloth and have not leaked at all. Would you care for these two pictures in shape for the Bulletin; if so, wire and we will get them ready.

A duplicate cylinder was immediately fitted and preparations made for another trial. This was last Saturday. While testing, a wire broke; this caused a little delay and some water, probab ? l y from the radiator, got on the distributor causing the secondary spark to “wander” and not distribute properly. This, of course, made the engine skip. We 10 worked on this until dark but were unable to dry the distributor or get it running without skipping. We also had some trouble from water ge c t ting in the cylinders due to our using a valve dome purchased of the Franklin people, which was done to save time. These domes fasten on by two studs, the draw of which pulls the metal in the cylinder head out of round and caused the leak.

After our troubles Saturday we held council and decided not to make another attempt until this trouble was eliminated by new valves, which were being made and which will go into the engine to-night. We are running 22 hours a day on this work. At one time, some days ago, there was just one man in the whole machine shop who was not working on this engine. Ordinarily, however, but a few men can work on it at a time. This, of course, was during its construction.

There has been plenty of time to make the changes we are now making, but we did not know at the time they were needed, the engine having run all right, the accidents happening only when we went to make a trial. John suggested yesterday we put a heavy automobile engine in the “Silver-Dart” and see what we could do. The regular engine, however, will be ready before this could be accomplished.

We have read so much of the Wrights and others flying, not to mention the fact that we should have been through here long ago, that we are getting very uneasy.

I don't like to write this letter any better than you like y t o read it, and here is hoping that our next report will be more encouraging.

(Signed) G.H. Curtiss.

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McCurdy to Bell .

To A.G. Bell, Baddeck, N.S.

Hammondsport, N.Y., Nov. 25, 1908 :— Mr. Karl Dientsbach was down in Hammondsport for a few days last week and while here read me an article, which he wrote for a German Aeronautical Magazine, on th ? e work of the Aerial E ? x periment Association.

I thought it a remarkably good account and perhaps it is the only account of our work from the organizing day till the present time that has been written by an outsider, and what is still more the facts and reasoning stated are correct. I made afew corrections of facts. and had him translate it for me, and it is this article which I enclose. Perhaps we might incorporate it in our Bulletin.

Just received the latest number XX. The photographs are exceptionally good. I don't think you know how much we all appreciate your efforts to have these Bulletins assembled like a Swiss watch. They are certainly fine and will be invaluable in time.

We have not written up a detailed description of the experiment to be tried on the water with the “Loon” because we thought it would sound better after we had tried it out. I have made notes of all the changes made in its construction in my note book with the dates attached. Won't it be fine if, it proves a success. I think that if we can manage to maintain a constant push of 25o–300 lbs. we will do the trick. Mr. Curtiss thinks that to-morrow will see the engine as he wants it and if all goes well the “Loon” will make its debut. 12 That will only be a matter of a few hours and then the engine will go right up the Valley, to be installed in the “Silver-Dart”.

Please understand that no time has been lost in the “Loon” experiment. It was simply made ready in spare time while we had nothing to do except wait for the completion of the engine.

If all goes well with the Silver-Dart, I suppose we will fly her for about a week or more and do you think it would be possible to work in a second trial for the Scientific American Trophy. We can tell at once if we have any chance and the fact of trying for the Trophy would not keep us here any longer than we otherwise would stay.

Mr. Post assures us that we can have a trial whenever we wish and I am sure that he will do all he can for us. Please let me know at once what you think about it, so that we can have a date set as soon as we all are sure that we can fly the 25 kilos. or more. Did you ever receive the big batch of mounted photographs I sent you long ago.

(Signed) J.A.D. McCurdy.

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Curtiss to Bell.

To A.G. Bell, Baddeck, N.S.

Hammondsport, N.Y., Nov. 27, 1908 :— We have Bulletin No.XX, and I wish to compliment you as the Editor. This issue is, I believe, the greatest yet. Should like to comment, however, on your article on Hammondsport experiments p.3, in which you have taken the weight of the power plant at 365 pounds, and call attention to the fact that 110 pounds for gasoline and oil would cover an extremely large supply. For experimental work the weight of 15 or 20 pounds would be sufficient for the fuel. The weight of the engine has also been reduced and the chain transmission added without increasing the weight of these parts. It is safe, therefore, to figure the entire power plant under 300 pounds, and I believe we will get a push from the propeller of 350 or more. The alterat ?? ?? s on the engine have been completed and it is in the “Loon” ready for trial. We are looking for a quiet afternoon to-day.

(Signed) G.H. Curtiss.

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BEINN BHREAGH EXPERIMENTS REPORTED BY ASST. EDITOR .

Experiments with the “ g G et-Away” and model of Drome No. 5 .

Nov. 27, 1908: — Half-sized model of drome No.5 was flown over the water, being launched from the “Get-Away” which was towed by the Gauldrie. This is the first time the “Get-Away” has been used.

There was quite a stiff breeze about 18 miles an hour, and the Gauldrie had all she could do to keep headway while the experiments were being carried on.

The model of No.5 rose nicely from the “Get-Away” when the tilting arms were lifted. In addition to her own weight the kite carried up a piece of lead on her nose, a sea anchor, three floats, and an auxiliary line which was taken on board the “Get-Away” for the purpose of landing her on same. The days experiments went with the precision of clock-work and after making the following observations, the kite was landed without accident on the “Get-Away”.

OBSERVATIONS .

Wind 18.15 miles per hour.

20.05 miles per hour.

16.50 miles per hour.

3 Obs. 54.70

Average 18.23 miles per hour.

Altitude.

25

26

28

32

19

24

23

27

Pull

70

100

80

130

120

90

70

110

15

Altitude

22

28

25

23

27

28

14 Obs 357

Average 25.5

Pull

130

110

100

90

120

56

170

80

70

60

18 Obs. 1756 lbs.

Average 97.6 lbs.

or 44310 gms.

WEIGHT .

Whole structure with 3 floats 56 lbs. or 25424 gms.

Flying line (wet) 4230 gms.

Dangling line 940 gms.

Lead on nose 382 gms.

Sea anchor 390 gms.

Two keel sticks to be added to weight of Kites 90 gms.

Total 31456 gms.

Model of drome No. 5 contains 738 cells.

Total surface 40 sq. meters.

Ratio 786 gms. per sq. meter.

Efficiency 1.265.

G.H.B.

(approved) A.G.B.

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BALDWIN'S EXPERIMENTS WITH THE DHONNAS BEAG .

Nov. 16, 1908 :— Mr. Baldwin has had three sets of new hydro-surface s made. The uprights have a series of holes bored in them for the attachment of the blades so that he can take out or put in blades at different distances apart as desired.

In experiments to-day th ese ree of these surfaces were used in each set. The Dhonnas Beag was propelled by a four-bladed propeller two meters in diameter and 30° angle at the tip, covered with nainsook and varnished with shellac. It was driven indirectly by gearing 3–1.

Mr. Baldwin reports that the boat lifted with some indications of speed but no records have been preserved. G.H.B.

Nov. 18, 1908 :— The Dhonnas Beag was tried to-day with the same outfit used Nov. 16 excepting that the hydro-s i u rfaces employed consisted of a set of five blades placed under the the boat in the bow and two sets, one to port and one to star-board of three blades each placed a little abaft of abeam.

These hydro-surfaces are not cut back to reduce resistance but present a cutting edge perpendicular to the line of advance and set at an angle of 5°.

The boat lifted more asterm by the bow. The four-bladed propeller seemed to give a better push than the two two-bladed propellers driven in opposite directions but the torque was quite noticeable. G.H.B.

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Nov. 19, 1908:— The Dhonnas Beag was taken out to-day with the same equipment as in experiments Nov. 18, but it was not long after the engine started that the chain parted. Mr. Baldwin thought that the parting of the chain was due to the fact that the engine was somewhat loose on the engine bed. This ended the experiments for the day. G.H.B.

Nov. 20, 1908 :— The Dhonnas Beag was tried to-day with the same equipment used in experiments Nov. 19.

Exp. 1. The boat came out high in the bow. Speed.

100 m in 32 sec. down

100 m in 33 sec. up

200 m in 65 sec.

The torque was very noticeable in that the star-board outrigger was forced under the water. The boat tended to turn to the right. This turning action had to be neutralized by steering hard to port with the boat's rudder.

Exp. 2. The Dhonnas Beag was then towed by the Skidoo with the engine on board but without a man. The boat still lifted high in the bow. Half way down the course Bedwin got aboard the Dhonnas Beag and the pull was found to be 95 lbs. There was ice in the harbor near the shed. G.H.B.

Nov. 21, 1908 :—Two new propellers revolving in opposite directions have just been completed. They are 15° at tip, 6½" diameter geared at 8 to 20. They gave a steady thrust of 100 lbs., maximum thrust 110 lbs. G.H.B.

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Nov. 23, 1908 :—Mr. Baldwin not having been able to produce results with his hydro-surfaces at all comparable to those obtained Oct. 27 and 28, it was determined to repeat the old experiments to-day.

On Oct. 27 his hydro-surfaces gave an efficiency of 14 1.e. they supported 14 times the pull of the towing-line but as it was believed that there must be something wrong wit ? h the spring balance employed the experiments were not noted in detail in the Bulletin

(No. XVIII p.28). On Oct. 28, 1908, Bulletin XVIII, p.29, the experiments were repeated with a new spring balance, the accuracy of which was tested before employing it in the experiments. In this case the efficiencies obtained were:— Exp. 1,10.96; Exp. 2, 12.9; Exp. 3, 12.16. The arrangement of hydro-surfaces employed is shown in Bulletin XVIII, p. 30, and the same arrangement was used this morning.

Exp. 1 The Dhonnas Beag without its engine or propeller was towed by the Skidoo. Starting from the Aerodrome shed the boat was towed down the harbor and out into Baddeck Bay as far as the Laboratory wharf and then cruised about Baddeck Bay in open water. The water was smooth, there was no wind either way. Mr. Baldwin thinks that the boat must have been towed at least three miles with the dynamometer under constant observation. He reports the pull as perfectly steady at 25 lbs. when the boat was clear of the water and well balanced. The lateral stability was defective and when she leaned over so that one of the outrigger floats touched the water she skewed around to one side and the pull went up to a maximum 19 of 35 lbs. John MacLean was on board and by leaning over to the high side was able to restore the equilibrium when the pull at once became steady at 25 lbs, the boat being completely out of the water supported upon her hydro-surfaces. The boat weighed 165 lbs., man 135, total 300 lbs.

As a general result a pull of 25 lbs. lifted 300 lbs. so that the efficiency was 12, thus verifying the results formerly obtained with the same arrangement. While in the harbor the speed was measured at two points. First observation gave 100m in 30 sec; second observation 300 m in 92 sec.

Exp. 2. The hydro-surfaces used in experiments November 18 were then substituted for the old set referred to above in Exp. 1, but there were five blades in the bow set and each of the after sets had four, making a total of 13 blades each having an area of 60 sq. inches giving a toal area of 780 sq. inches. The area of the blades used in experiment 1 was 816 sq. in. The Dhonnas Beag was towed by the Skidoo with Baldwin on board making a speed of 100 m in 32 sec. down. Boat weighed 160 lbs; Baldwin 185 lbs total 345 lbs, and the pull was 60 lbs. yielding an efficiency of 5.75. The boat came clear of the water.

Exp. 3. At lower end of course Bedwin got aboard D.B. with Baldwin. The D.B. did not come out of the water and the pull registered from 90 to 100 lbs.

Exp. 4 The rear planes were set at a less angle and the pull came down to 70 lbs.

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Weight .

Baldwin 185

Bedwin 155

Boat 160

Total 500 lbs.

Pull 70 lbs.

Remarks:— Boat did not clear herself.

Exp. 5 D.B. was dry-docked and three sets of hydro-surfaces were used as before only the number of blades was changed making a set of four blades in the bow and two sets of four blades each, one to port and one to starboard. Making in all 12 blades giving an area of 720 sq. in.

WEIGHT .

Baldwin 185

Boat 160

Total 345 lbs.

Pull 50 lbs.

Time 100 m in 31 sec. down.

Efficiency 6.9

Remarks:— Boat cleared herself.

Exp. 6. Bedwin then got aboard with Baldwin.

WEIGHT.

Baldwin 185

B o?? edwin 155

Boat 160

Total 500 lbs.

Pull 60 lbs.

Boat did not clear herself.

Exp. 7. Baldwin then got aboard Skidoo and left Bedwin on D. B.

WEIGHT.

Bedwin 155

Boat 160

Total 315 lbs.

Pull 43 lbs.

Efficiency 7.32

Remarks:— Boat cleared herself.

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GENERAL REMARKS .

It is obvious that the hydro-surfaces employed in experiment I are more efficient than those in experiment 2 and more efficient than the reefing hydro-surfaces employed Nov. 7 (Bulletin XX, pp 36–37). In fact they are the most efficient that have yet been produced and are perfectly satisfactory that so far as lift is concerned. They are deficient however in stability and this is probably due to their arrangement (see Bulletin XVIII, p. 30).

On the other hand the reefing hydro-surfaces (see Bulletin XX, p. 37) when arranged with one set at the bow and two sets aft about under the center of gravity one on either side of the boat seemed to possess stability without great lift suggesting the idea that the lack of stability noted in experiment I might be remedied by employing three sets of the most efficient hydro-surfaces copying the arrangement employed with the reefing hydro-surfaces.

Having obtained hydro-surfaces that are satisfactory in lifting power the idea is to let well enough alone and instead of spending too much time upon trying to improve the good lifting power obtained tackle the question of stability. G.H.B.

(Approved). F.W.B.

Nov. 28, 1908 :— The following were the conditions of to-day's experiments. Three sets of straight-edged hydro-curves 3 ft. by 3# in. with three vertical supports in each. The curvature was one in fifteen at # from leading edge. Two sets 22 in front set 4 ft. 9½ in. from bow. The third and single set placed at the rear 4 ft. 6 in. from the stern. Each set contained two superposed surfaces set at an angle of 5° making a total of 6 surfaces. The wieght of the boat with surfaces attached was 146 lbs. Throughout the day's experiments the Dhonnas Beag was towed by the Skidoo.

Exp. 1. Boat 146 lbs.

J. MacLean 145 lbs.

Total 291 lbs.

Pull 20 lbs.

Efficiency 14.55

Remarks:— The Dhonnas Beag rose out of the water on her hydro-curves. The stability was good.

Exp. 2. Boat 146 lbs.

MacDonald 189

MacLean 145

Total 480 lbs.

Pull 70 lbs.

Time 100 m in 29 sec.

Efficiency 6.86

Remarks:— The Dhonnas Beag rose well clear of water the stability being good. Boat did not lift as high out of the water as in Experiment 1.

Exp. 3. Boat 146 lbs.

MacDonald 189

Total 335 lbs.

Pull 26 lbs.

Time 100 m in 30 sec.

Efficiency 12.88

Remarks:— Dhonnas Beag rose out of water the stability being good.

23

Exp. 4 Boat 146 lbs.

MacDonald 189

Total 335

Pull 30lbs.

Time 100 m in 30 sec.

Efficiency 11.17

Remarks:— The Dhonnas Beag rose well out of the water, the stability being good. On returning to the wharf eel-grass was found on the hydro-surfaces.

Exp. 5 The above experiments were reported by Mr. Baldwin. An experiment was then made with the Dhonnas Beag propelled by her own motive power and mounted on hydro-surfaces with same arrangement as in above experiments. Two double-bladed propellers rotating in opposite directions were used driven by Curtiss No. 2 engine, Mr. Baldwin being aboard. The Dhonnas Beag came well clear of the water rising perhaps 1½ ft. from the surface. She also had good port and starboard as well as fore and aft stability. She had hardly gathered speed when the deck near the forward hydro-surfaces smashed. Baldwin immediately shut off power and Dhonnas Beag was towed safely to the wharf after a most successful day of experiments. G.H.B.

Nov. 30, 1908: — The Skidoo not being available and the Gauldrie being overhauled, we could not try flat surfaces so tested one of the new propellers.

Propeller:— 88 in. diameter; 22½ degrees at tip; solid construction; weight with shaft 31 lbs; chain drive; geared 3 to 1; maximum pull 125 lbs; steady pull 120 lbs. The driving chain snapped before pull could be noted and above results were obtained after repairs had been made. Second chain also gave way soon after making observations. G.H.B.

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Dec. 1, 1908 :— Mr. Baldwin reports experiments this morning with the D.B. in which hydroplanes instead of hydro-curves were used. Two sets in front and one in rear the arrangement being the same as that of the hydro-curves used Nov. 28. Both on Nov. 28 and to-day vertical supports were employed instead of sloped-back supports. In each set there were two blades vertically above one another separated by a space of six inches, so that the only difference between the arrangement used Nov. 28, and to-day was that the surfaces used Nov. 28, were curved blades whereas thise used to-day were flat. The object of this morning's experiment was to ascertain whether the great efficiency noted Nov. 28 was due to the curvature of the surfaces. The D.B. provided with flat surfaces was towed down the harbor to-day by the Gauldrie making a speed of 100 m in 33 sec. There was considerable slush ice in the harbor, and the boat was taken out into the Bay so as to have clear water. The D.B. has been repaired since her accident Nov. 28 and weighed 155 lbs.

Exp. 1 Boat 155 lbs.

J. MacLean 142.5

Total 297.5

Pull 52.9

Efficiency 5.6

Remarks:— The above experiment was made with the D. B. well clear of the water. The efficiency with the hydro-planes is very much less than with the hydro-curves. Efficiency with hydro-curves obtained Nov. 28 were Exp. 1, 14.55; Exp. 3, 12.88; Exp. 4, 11.17; efficiency with hydroplanes obtained to-day 5.62

Exp . 2 . In order to test the matter th o roughly the hydro-curves used Nov. 28 were replaced upon the D.B. and experiments 25 repeated this afternoon with the following results.

Exp. 2. Boat 155 Pull 28.3 J. MacLean 142.5 Time 100 m in 30 sec. Total 297.5 Time 100 m in 31 sec.

Efficiency 10.51

Remarks:— The Dhonnas Beag was tried this afternoon with the hydro-curves used Nov. 28 towed by the Gauldrie.

Exp. 3. Boat 155 Pull 22.5 J. MacLean 142.5 Total 297.5

Efficiency 13.22

Remarks:— Coming back from the Bay the above observations were made with the boat completely out of water supported on her hydro-curves.

As a general result of these experiments it can no longer be doubted that the hydro-curves are more efficient than the hydroplanes.

Exp . 4 . An experiment was then made to ascertain the lowest speed at which the hydro-curves would support the Dhonnas Beag out of water. When Gauldrie made 100 m in 38 sec. the boat was supported; upon slowing down to 100 m in 40 sec. the boat was still supported out of water. This was the lowest speed attempted. The average pull was from 40 to 45 lbs. This ended the experiments for the day. When the boat was taken out of the water some ell-grass was found upon the blades. G.H.B. (approved) F.W.B.

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C.17. taken 1908 Nov.20 Dec. 1908.

27

C59. 1905 Nov 27 1908 Nov 27

C60. Taken 1908 Nov. 27 , 1908 Nov 27

28 1–21 , 1908 Nov 1908 Nov 29

1908 NOV24

30 31

C19. Taken 1908

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THE WORDS “AEROPLANE” AND “AERODROME”: By Gardiner H. Bell.

Just as the art of Aviation is new, so are the terms we use in application to the art. There seems to be some question as to the technical application of a number of these words.

Let us first take up the question as to the use of the word “aeroplane”. Mauro, Cameron, Lewis & Massie in relation to patent matters, have used the word “aeroplane” in reference to the Hammondsport machines. The question immediately arises, are the Hammondsport machines aeroplanes? It is true that they are universally known as such but technically have we any right to use the word “aeroplane” when we are speaking of heavier-than-air machines whose supporting surfaces are not planes but curves?

We must admit that the following sentences quoted from Patent matters do not sound technical to say the least.

“In a flying machine the combination of a pair of superposed aeroplanes spaced fartherest apart at their central positions and gradually approaching each other towards their lateral edge portions etc.”. and again

“In a flying machine the combination of a plurality of concavo-convex aeroplanes united with the concave surfaces toward each other etc”.

In the above sentences the composer has used the word “aeroplane” in speaking of the curved portions which constitute the supporting surfaces. Perhaps this brings the point home more clearly than when the machine as a whole is termed “aeroplane”.

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Then there is the word “aerodrome”, sometimes used in speaking of the machine; sometimes in speaking of the shed in which the machine is housed; and sometimes in connection with the imaginary track on which the machine travels. It is an easy matter to trace the origin of each of the above applications of the word and it may be said that there is something to argue in favor of each.

However it may be, one thing is certain; that in order to converse intelligibly on the subject of Aviation we must cut our technical words down to one and only one meaning. I think most of us will agree that the following sentence would be somewhat misleading.

“The doors of the Aerodrome were opened and the aerodrome was wheeled over to the Aerodrome”.

G.H.B.

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Mauro, Cameron, Lewis & Massie to Bell.

To A.G. Bell, Baddeck, N.S.

Washington, D.C., Nov. 24, 1908 :— We are in receipt of your Editorial Notes and Comments under date of Nov. 18, 1908, in which you criticise the use of the expression “aeroplane having a concave and a convex surface”. It is true, as you state, that a plane cannot have a concave and a convex surface but we are not talking of planes but aeroplanes, two very different things. It is true that a plane cannot have a concave and a convex surface, and it is equally true that an aeroplane can have such a concave and convex surface.

There is a clearly defined distinction between a geometrical plane and an “aeroplane”. This latter term is not confined to a structure which would fall within the definition of a geometrical plane. It is defined in the dictionaries as a flying machine having supporting surfaces or wings, and in this sense it refers to the entire machine. Thus, we would speak of Wright's machine as an aeroplane, and just as surely the June Bug is an aeroplane.

The term “aeroplane” also has a more specific meaning, that is, the supporting surface in that class of machines broadly designated as aeroplanes. You will recall that we have the authority of the Wright Brothers (who are certainly entitled to be regarded as authorities in this art) for the use of the term in this sense.

Referring to your suggestion that there should be some statement or definition in the specification as to the 35 meaning of the term “aeroplane” if we employ it, we should not object to this, but, unless it is absolutely called for, we think it undesirable, because some infringer might manage to evade the definition and thus escape the charge of infringing the claims.

The law requires that the specification of the patent shall be couched in such clear, concise and exact terms, as will enable one skilled in the art to make, construct and use the device . Now, we will venture the assertion that there is not a flying machine man in the world who would not call your machine an “aeroplane”, and who could not, from the description which is embodied in the specification submitted, construct and use the machine, and who would not perfectly understand the term “aeroplane” as employed therein.

Mr. Cameron carefully considered this very question when drawing the specification and deliberately adopted the term “aeroplane” because, in his judgment, there was no other expression known to the art which would as fully and completely describe the structure to one skilled in the art as the term “aeroplane”.

The term “aero-surface” suggested by you does not appear to us to be as apt as the term “aeroplane”. It is a coined word, it has no known and well defined meaning in the art, and would necessarily require definition in the specification in order to fix accurately the meaning which was to be given to it in the specification. On the other hand, “aeroplane” has a well defined fixed meaning in the art, as is readily understood by all.

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We beg that you will recognize that there is no personal pride involved at all in the above suggestions. We are interested, as we know you are, only in getting the most apt expressions and the strongest patent possible under the circumstances, and we shall be most happy to make any changes or to adopt any descriptive terms which appear, after full di z s cussion, to be the best. We are satisfied, however, that the criticisms suggested in your Editorial Notes of the use of the word “aeroplane” are not well founded from a patent standpoint, and that the suggested substitute is more undesirable than the term already employed.

(Signed) Mauro, Cameron, Lewis & Massie.

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Bell to Mauro, Cameron, Lewis & Massie.

To Mauro, Cameron, Lewis & Massie, Washington, D.C.

Baddeck, N.S. Dec. 4, 1908: —Your note of Nov. 24 received. I am glad to know that my criticisms relating to the use of the word "aerop al la ne" are not well founded from a patent standpoint.

There are other points of view, however, and your letter is suggestive of a new conundrum.

"When — oh when — is a plane not a plane?

Answer: When it is an Aeroplane! !! according to Messrs. Mauro, Cameron, Lewis & Massie! This may perhaps not be appreciated as a joke in the patent office but I can assure you it sounded very like one to me when I first read it in your letter!

Seriously, the whole matter of terminology requires looking into. Mr. Cameron must not for one moment suppose that my criticisms in any way reflected personally upon him. He is of course not responsible for the absurd terminology employed by the Public; and he has only followed, in the specification, the ordinary usage of the day.

I expect to arrive in Washington on the 14th of December and to remain there until the 18th and would like to have a conference with Mr. Cameron concerning the specification during my visit there. I must say that the whole specification impresses me with the feeling that it has been prepared with great care and thought, and it will be a pleasure to look it over with Mr. Cameron himself.

(Signed) Alexander Graham BeLL.

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THE OUTLOOK ON AVIATION: By the Asst. Editor.

The November Number of “aeronautics” has at last arrived. It describes, in this issue, the Herring aeroplane. It also contains an article on “The Increased Lifting Effect of Curved Aeroplanes” by Edward W. Smith. There is given quite a detailed account of the aeronautical meet at Morris Park.

NEWSPAPERS .

For the first time on record the Wright aeroplane was operated solely by a stranger, M. le Comte de Lambert on Nov. 23. It is reported that a few days later Wright brought his machine to the ground, describing a spiral path, and lighted without accident. There is a report that Wright intends flying with two men besides himself.

A Russian by the name of Bolotoff is having constructed by the Voisin Bros., a triplane which seems to be arousing considerable attention. It is to be driven by a 100 H.P. Panhard engine and is built, as nearly as can be judged by a very poor accompanying illustration, to resemble the form of a bird. The machine is 33 ft. in length, its wings measure 21 ft. from tip to tip.

There has been a split in the French Aero Club in the form of a League Nationale Avienne which in a few weeks obtained five thousand supporters and considerable sums in prize money. As a result of the split the Marquis de Dion and M. Archdeacon have resigned from the Mother Club.

On November 6 Lieuts. Lamb and Winter and Holland 39 Forbes made a successful trip to Annapolis, M.D., in the Government dirigible. It is intended to make a flight to Baltimore in the near future.

The Aero Club of the United Kingdom has decided to present to the Wright Bros. its gold medal, at a dinner to be given in honor of Wilbur Wright in London before the end of the year.

Baden-Powell seems to be of the opinion that not enough attention has been paid to head resistance throughout the construction of the Wright machine. He also doubts that the system of warping the planes is an important feature in navigating the machine.

Fournier, a Frenchman, is working on a biplane in this country. The machine is to be driven by a 50 H.P. four-cylinder gasoline engine.

The word “Drome” seems to have been excepted by the public, and especially as applied to the Hammondsport machines.

An armoured automobile designed to destroy airships is under construction at Berlin. Its armament consists of a rapid fire 5 centimeter gun capable of dis h c harging 24 times a minute.

A sc j h ool of flight has been started in Belgium. An ingenious apparatus for teaching pupils in actual flight is used. It consists of a “captive aeroplane” which is towed through the air by a long cable winding round a drum. New York Herald, Nov. 23, 1908: —Two brothers by the name of Gemma living in Norvora, have invented an aerop al la nes which 40 from its planes they call an “aerocurve”.

Paris, Sunday :—The Auto Aero Committee of the Auto Club of France has decided to organize a grand prize for Aviators. The prize will be competed for in 1908 and its value will be about $40,000.00

The Russian Government is looking into the Wright machine.

FRANCE .

It has been figured that the total duration of Wilbur Wright's flights up to October 7, inclusive, amounted to 11 hourse, 32 minutes. Up to Oct. 10, twenty-six persons have been carried, including three women and a boy. In the 2 hour 7 minute flight of September 28, Wilbur Wright won the Commission d'Aviation prize of 5000 frances, open till September 30, for a closed circuit flight of 5 kilometers.

WRIGHT .

On the 9th of October, he made six flights of about 4 minutes, average, with Lazare Weiller, Baron Deutsch and Engineer Berheim as passengers.

On October 10 Wilbur Wright carried Paul Painleve for 1 hour, 9 minutes, 45 seconds. The official distance was 55 kilometers, but considering the curves, it must have been about 80 kilometers. There was no wind blowing; the flight ended after dark, having been delayed on account of the mending of a wire stay, made necessary by a false start. It was the third long passenger flight, having been preceded by one of 55 minutes, 37 seconds, and one of 1 hour, 4 minutes 26 seconds.

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The Weiller syndicate has conceded that the flights have fulfilled conditions and have paid the first instalment of 250,000 francs to Wright.

On Oct. 15 two flights were made of 1 minute, 38 sec. and 2 minutes, 35 seconds, carrying first Mercanti and second Rene Gasnier, who was in the Gordon Bennett race from St. Louis last year. Wright stopped his motor when at a height of 60 ft. and made a smooth glide to earth.

On Oct. 21 Wilbur Wright made a flight of 6 minutes, 40 seconds, covering 17 kilometers in a strong wind. On Oct. 23 he made another flight of 2 minutes and 30 seconds, following which were flights carrying a passenger of 3 minutes, 17 seconds; 4 minutes, 58 seconds, and 3 minutes, 2 seconds.

On Oct. 28 Count de Lambert began his lessons as an apprentice-aviator. For his first lesson he had three flights of 12, 8, and 15 minutes. On the following day the master and pupil made three more, 7 minutes, 5 seconds; 17 minutes, 34 seconds, and 19 minutes, 25 seconds respectively.

On Oct. 30 one of the connecting rods of the motor broke and smashed through the crank case, while the machine was in mid-air. The descent, however, was made without trouble. In a recent interview Wilbur Wright stated that the success of his machine was especially due to the high efficiency of its propellers, and that light motors were not essential and flight could as well be attained with a steam engine . He claims 70 per cent efficiency for his propellers.

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FARMAN .

On Sept. 30, in competition for the Aero Club 5000 franc prize, Farman accomplished a flight of 35 minutes, 36 seconds, covering 34 kilometers. On Oct. 2 he succeeded in remaining in the air 44 minutes 32 seconds, covering 42 kilometers at Chalons. On Sept. 28 Farman made another long flight, and again another of about a mile with M. Painleve aboard. Following these, for the first time in the history of aviation a flying machine traveled from one town to another. Leaving the plains of Chalons on Sept. 30, no stop was made until he descended just outside Rheims, a distance of 27 kilometers, 20 minutes later. His course took him over the houses and trees and the photographs of the flight bear witness.

BLERIOT .

On Oct. 2 the Bleriot VIII made a flight of 4 minutes. On Oct. 22 Bleriot tried for the “high prize” and accomplished a flight of 6 minutes, 40 seconds in a gusty wind. On the following day another attempt was made, but the motor stopped on account of too much gas feeding, and in landing the machine was damaged. On Oct. 30 still another attempt was made, but the motor again stopped. The next day, after a short flight in the morning, he set off in the afternoon for Artenay a small village, and 9 miles were covered before landing. After a few necessary repairs the monoplane started back, but had to stop once on the way.

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PELTERIE.

The Pelterie Aeroplane, No. 2 has just been finished on the general lines of No. 1.

ENGLAND .

Mr. Moore-Brabazon has received the triplane he ordered from the Voisin Brothers, and will soon start experimenting with it. It is provided with a regular make of automobile motor, the Metallurique.

The Daily mail has offered a new prize of $2500 to a gasless machine which flies over the English Channel in either direction. The least width is 21 ½ miles.

The Aero Club of the United Kingdom has elected the Brothers Wright to honorary membership and presented their gold medal for 1908 to them.

The British Army's first aerodrome, which had such successful trials, unfortunately met with disaster recently and is now a total wreck. When twenty feet or so above the earth it suddenly swooped and struck the ground with some force.

GERMANY .

On Oct. 24 the overhauled Zeppelin I the first fully successful representative of its type, was sailed for the first time. With all the improvements incorporated in it, after the experiences with the illfated No.4, it ha d s proven a wonderful success. Prince Henry of Prussia made a very extended trip of seven hours on Oct. 27, being so delighted by his experiences that he continued many hours longer than 44 expected.

On November 7 the Crown Prince of Germany shared his experience. By the decision of Gen. von Einem, the Minister of War, the Zeppelin ship has been bought by the War Office. The National subscription for the construction of Zeppelin's airships totals nearly seven million francs.

SPAIN.

At the park of Guadelajaza, Capt. Kindelan and Mr . Torres Querdo are testing a small dirigible of 950 cubic meters. It has two 34 H.P. motors, driving two propellers of 1.5 meters diameter placed at both sides of the car.

ITALY.

The new Italian war dirigible has undergone its first trials very successfully over Lake Bracciano, with Major Morris, Capt. Crocco and Ricaldoni and a mechanic. It is constructed on scientific lines by Major Morris. The envelope possessed a fish-like form of least resistance.

AUSTRIA.

The Wels-Etrich monoplane is nearly completed, driven by a 24 H.P. Antoinette motor, with a single traction screw.

BELGIUM .

In the newly-opened exposition for arts and crafts at Brussels is seen an ornithopter of M. de la Hault, furnished with a motor of 100 H.P., of only 800 lbs. total weight a propeller for dirigibles by Mr. Kluytmans that is placed in the center of the car, and an aeroplane model by a Mr. Koch , with improved stabilizing devices.

45

NOTES FROM NATURE .

The following notes from “Nature” may be of interest. Nature, Nov. 12, 1908 :—On Nov. 6 an inaugural meeting of the Aeroplane Club was held in London, when it was decided to form a club devoted to the development of aerial navigation by machines heavier-than-air. A small provisional committee was appointed to submit to the Club the names of gentlemen for service on a general committee.

The Paris correspondent of the Times reports that M. Barthou, the French Minister of Public Works, announced in the Senate on Nov. 5 that the sum of 4000 l. is to be devoted by this department to the encouragement of aerial locomotion. From the same source we learn that the International Sporting Club of Monaco has offered the sum of 4000 l. to be competed for at an international aeronautical meeting to be held at Monaco from January 24 to March 24, 1909. The length of the course will be about six miles. The first prize will be 3000 l., the second 600 l., and the third 40 l.

AERO CLUB OF AMERICA .

At a meeting of the Aero Club of America, the following resolution was unanimously passed:—

“RESOLVED that the Club offer to take charge of funds for the erection of a monument in memory of Lieut. Selfridge and ask the members so inclined to contribute”.

A unanimous resolution was passed by the Aero Club of America to give Wilbur and Orville Wright suitable gold medals. It is proposed that these medals be handed to the Wrights at a banquet to be given by said Club.

46 INVENTOR TYPE H.P MOTOR NO. OF PROPELLERS. NO. OF LADES IN EACH DIAMETER OF PROPELLER IN M. PITCH IN M. Breguet Gyropl 40 Antoinette 2 4 7.85 Koechlin-Pischof Monopl 20 Duteil & Chalmers 1 2 *1.65 1. *also 1.55 Koechlin-Pischof Monopl 15 Duteil & Chalmers 1 2 Dufaux Bipl 100 Dufaux 2 2 2.8 Bleriot VIII Monopl 50 Antoinette 1 4 2.2 1.3 Bleriot IX Monopl 75 ? 1 4 2.1 1.3 Bleriot Monopl 24 Antoinette 1 2 1.6 0.98 Bertin Helicopt 120 Bertin 1 2 2.2 Auffm-Ordt Monopl 35 R.E.P. 1 2 2.5 Blanc Monopl 35 R.E.P. 1 2 2. 1.2 Roesch-Seux 50 2 2 2. 1.2 Cornu Helicopt 24 Antoinette 2 2 6. 2.7 Kapferer Monopl 35 R.E.P. 1 2 2.1 1.3 Kapferer Bipl 20–25 Buchet 1 2 1.6 1. Farman I Bipl 50 Antoinette 1 2 *6.89 *3.61 *feet Farman I-bis Bipl Antoinette Farman II Bipl 35 Renault 1 2 2.5 Farman II Bipl 50 Antoinette 1 2 2.1 1.1 In August, 1908, Garman gave E.L. Jones diameter as 2.3; pitch 1.4 47 Vaniman Tripl 70–80 Antoinette 2 Bonnet-Labranche Bipl 70–80 S.A.C.A.A. 1 2 Hughes Tripl 10 Hughes 1 1.5 Hervieux Monopl 18–24 Gasnier Bipl 40 Antoinette 2.2 Goupy Tripl Renault 1 2 2.3 1.4 R.E.P. I Monopl 25 R.E.P. 1 R.E.P. II Monopl 35 R.E.P. 1 4 R.E.P. II-bis Monopl R.E.P. 1 4 Santos Dumont 14-bis Bipl 1 2 2.0 1.0 Santos Dumont No. IX Monopl 20 Duteil & Chalmers 1 2 1.35 Santos Dumont 14 Bipl 50 Antoinette 1 2 Santos Dumont 20 Monopl 24 Antoinette 1 2 Santos Dumont Bipl 100 Antoinette 1 2 2.05 1.7 Detable Monopl 2 Herdtle-Bruneau French Military Tripl Caters Tripl English Bipl 50 Antoinette 2 2 48 Delagrange Bipl 50 Antoinette 2 2 2.1 1.05 Delagrange Bipl 50–60 Antoinette 1 2 Ellehammer Bipl 18 1 2 Ellehammer Tripl 30 Ellehammer 1 2 Gilbert Monopl Etrich-Wels III Monopl 1 1.5 Coanda Bipl 50 Antoinette 1 de la Vaulx Monopl 40 2 2 2.0 2.2 Gastambide I Monopl 50 Antoinette 1 2 2.0 1.3 Gastambide II Monopl 50 Antoinette 1 2 Gastambide III Monopl 1 2 Vuia Monopl 24 Antoinette 1 2 1.85 1.0 Witzig-liore-Dutilleul Part mono part bipl 50 Renault 2 2 3.0 2.5 Fritzche Ferbe Wind Wagon Wind Wagon 12/16 Pengeot 1 2 1.85 1.8 Ferber IX Bipl 50 Antoinette 1 2 2.2 1.1 Zens Bipl 50 Antoinette 1 2 2.0 Variable Zens Bipl 50 Antoinette 1 2 2.05 1.0 Pischoff Monopl 35 1 2.0 49 Pischoff Bipl 25 Anzani 1 2 Antoinette Monopl 100 Antoinette 1 2 2.5 AMERICA. Red Wing Bipl 40 Curtiss 1 2 6‘2“ 4‘ White Wing Bipl 40 Curtiss 1 2 June Bug Bipl 40 Curtiss 1 2 5.5‘ 6‘ 4‘2“ 4‘ Silver-Dart Bipl 50 Curtiss 1 2 8‘ 17–18° Kimball Helicopt 50 K & C 20 4 4‘ ½‘ Luyties Helicopt 20 2 4 35‘ upper 12° lower 13° Williams Helicopt 40 Curtiss 2 2 Williams (CW) Monopl Zerbe Monopl 40 Curtiss Heinfeld Wright Bipl 25 Wright 2 2 2.5 also given as 2.8

The above table was procured through the kindness of the Editor of “Aeronautics, and may prove of interest.

G.H.B.

BULLETINS OF THE Aerial Experiment Association

Bulletin No. XXIII Issued MONDAY, DEC. 14, 1908

ASSOCIATION'S COPY.

BEINN BHREAGH, NEAR BADDECK, NOVA SCOTIA

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Beinn Bhreagh, Near Baddeck, Nova Scotia .

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CONDITIONS OF SUCCESS IN THE DESIGN OF FLYING MACHINES: By O. Chanute. 1898.

After many centuries of failure, it is believed that we are at last within measurable distance of success in Aerial Navigation; that there will be two solutions, one with dirigible balloons, which will chiefly be used in war, and the other with dynamic, bird-like machines which will possess so much greater speed and usefulness that they should preferably engage the attention of searchers.

I have, of late years, experimented with six full-sized gliding machines carrying a man, comprising three different types, and having reached some definite opinions as to the conditions of eventual success with power driven machines, it is ventured to state them briefly for the benefit of other experimenters; for, final success will probably come through a process of evolution, and the last successful man will need to add but little to the progress made by his predecessors.

It is true that the most important component of the future flying machine will be the very light motor. It is the lack of this which has hitherto forbidden dynamic flight and restricted dirigible balloons to inefficient speeds, but it is also true that dynamic flight is impossible unless the stability be adequate. The progress made in light motors within the last ten years has been very great; Maxim, Langley and Hargrave have produced steam engines weighing but about 2 2 five kilogrammes to the horse-power, and hundreds of ingenious men are now improving the gas engine so rapidly that there is good hope that we shall soon be in possession of a prime mover which shall approximate in lightness the motor muscles of birds, which are believed to weigh but 3 to 9 kilogrammes per horse-power developed.

But even with a very light motor, success cannot be attained until we have thoroughly mastered the problem of equilibrium in the air. This fluid is so evasive, the wind so constantly puts it into irregular motion, that it imposes great difficulties even upon a bird, endowed as he is both with an exquisite organization, with life-instinct and with hereditary skill. It is to this one problem of equilibrium that I have devoted all my attention, in the belief that an inanimate artificial machine must be endowed with automatic stability in the air, and that experiments indicate that this can be achieved.

The wind is constantly in a turmoil; it strikes the apparatus at different points and angles, and this changes the position of the center of pressure, thus compromising the equilibrium. To re-establish the latter requires either that the center of gravity, (or weight) shall be shifted to correspond, or that the supporting surfaces themselves shall be shifted, thus bringing back the center of pressure over the center of gravity. Birds employ both methods; they shift the weight of parts of their bodies, or they shift either the position or the angle of their wings. It is believed that only the shifting of the wings is open to use for an artificial apparatus.

3

3 GENERAL CONDITIONS .

It is inferred, therefore, that inventors who begin by working upon an artificial motor, and who endeavor to evolve a complete flying machine at once, are beginning at the wrong end, and are leaving behind them two very important pre-requisites.

1st. That the apparatus shall possess automatic stability and safety under all circumstances.

2nd. That the apparatus shall be so light and small as to be easily controlled in the wind by the personal strength of the operator.

The general stability in the line of flight, the steering, can be obtained by a rudder, but the automatic equilibrium must be secured in two directions; first transversely to the apparatus, and secondly fore and aft. Very good results have been automatically obtained for the transverse stability by imitating the attitude of the soaring birds, the underlying principle of which consists in a slight dihedral angle of the wings with each other, either upward or downward, but the very best application of this principle is not yet evolved, and it requires more experimenting. Experimenters have found but little difficulty in securing stability in this transverse direction, but it must be worked out more thoroughly.

The longitudinal equilibrium is, however, the most precarious and important. I have tested three methods of securing it automatically.

First, by setting the tail at a slight upward angle 4 2 with the supporting surfaces, so as to change the angle of incidence of the latter through the action of the “relative wind” on the upper or lower surface of the tail. This is known as the “ p P enaud” tail; it is susceptible of great improvement in details of construction, as has been adundantly proved, but it is not yet certain that it will counteract all movements of the center of gravity in meeting sudden wind gusts.

Secondly, by pivoting the wings at their roots, so that they may swing backward and forward horizontally, thus bringing back automatically the center of pressure over the center of gravity, whenever a change occurs in the “relative wind”. The so-called “multiple-wing” gliding machine was of this type, and it reduced the movement of the aviator required to meet wind gusts to about 25 millimeters. It cannot, however, be said its construction is perfected.

Thirdly, by hinging vertically the supporting surfaces to the main-frame of the apparatus, so that these surfaces shall change their angle of incidence automatically when required. This last method has only been tested in models, other engagements having prevented experiments this year (1898). The other two methods have been applied to full-sized machines carrying a man. They have given such satisfactory results that not the slightest accident has occurred in two years of experimenting, but their adjustment has not yet reached the consummation originally aimed at, i.e. that the aviator on the gliding machine shall not need to move at all, and that the apparatus shall automatically take care of itself under all circumstances except in landing.

5

5 I shall be glad to furnish more minute descriptions to those who may want to repeat these experiments, or to apply the principles to machines of their own. The stability of an apparatus is the very first thing to work out before it is attempted to apply an artificial motor. This cannot be too strongly insisted upon, and the best way of accomplishing this pre-requisite is to experiment with a full-sized gliding machine carrying a man. This utilizes the ever reliable force of gravity until such time as the automatic equilibrium is fully attained. Then, and not till then, it becomes safe to apply a motor.

When artificial power comes to be applied, it is probable that the best motor to use at the beginning will be found to be a compressed air engine, supplied from a reservoir upon the apparatus. This is not a prime mover, but it is reliable and easily applied. It will probably afford a flight for but a few seconds, but this will enable the aviator to study the effects of the motor and propeller on the equilibrium of his machine. When this is thoroughly ascertained another motor may be substituted, such as a steam or a gasoline engine, which will produce longer flights, but this will require long and costly experimenting to obtain a light and reliable engine.

Another most important requisite is that the first apparatus with a motor shall be of the smallest dimensions which it is possible to design, and shall therefore carry only one man. This is requisite for four reasons: 1st. in order to keep down the relative weight which increases as the cube 6 6 of the dimensions, while the supporting surfaces increase approximately as the square; 2nd. In order to secure adequate control of the apparatus in the wind; 3rd. To diminish the power required for the motor, and 4th to have as little inertia as possible to overcome in landing. The whole apparatus should be so light and small that the aviator shall carry it about on his shoulders and control it in the wind. This can easily be accomplished with a gliding machine. My double-decked machine was of ample strength, with 12.5 square meters of supporting surface, weighing 11 kilograms, and carried a man perfectly on a relative wind of 10 meters per second. It showed an expenditure of 2 horse-power obtained from gravity. It is believed that a power machine can be built with 16 square meters of carrying surface, and a weight of 41 kilograms, which will carry a man and a motor of 5 horse-power, if the latterwith its propellers and shafts does not weigh more than 5 or 6 kilograms per horse-power. In fact this has been done with a compressed air motor machine, but the apparatus thus far has produced doubtful results, in consequence of defects in the motor. It is firmly believed that it will be a great mistake to begin experiments with a large and heavy machine, for it would probably be smashed upon its first landing, before its possibilities could be ascertained.

The speed first aimed at should be about 10 meters per second, and to achieve this the following are good proportions: 7

7 Sustaining surfaces 0.15 square meters per kilogram.

Sustaining surfaces 3.00 square meters per horse-power.

Equivalent head surface 0.25 square meters per horse-power.

Weight sustained 20.00 kilograms per horse-power.

DETAILS OF CONSTRUCTION .

The general arrangement and details of construction will conform of course, to the particular design to be tested by the experimenter, but some useful hints may be given. There need be no hesitation as to the materials to employ. The frame should be of wood, which although weaker than bamboo is more reliable and permits the shaping of the spars so as to diminish the head resistance. It has been found by experiment that the best d c ross-section resembles that of a fish, with the greatest thickness about one-third of the distance from the front edge; this reduces the resistance to co-efficients of one-sixth to one-tenth that of a plane of equal area, while a round section, such as that of bamboo, gives a co-efficient of about one-half. The spars of the frame can best be joined together with lashings of glued twine or with very thin steel tubing, preferably silvered or nickel-plated. The stays or tension members should be of the best steel wire, also nickeled-plated and oiled to prevent rust. A very important detail, not yet worked out, consists in connecting the wires to the framework so that they shall pull alike. The supporting surfaces should preferably be of balloon cloth or Japanese silk, varnished with two or three coats of Pyroxelene (collodion) varnish which possesses the property of shrinking the fabric upon drying, so as to make 8 8 it drum-like.

(A good recipe for this varnish is as follows:— Take 60 grams of gun cotton No.1 dampen it with alcohol to make it safe to handle, and dissolve it in a bottle containing a mixture of 1 liter of alcohol and 3 liters of sulphuric ether. When well dissolved, add 20 grams of castor oil and 10 grams of Canada Balsam. This is to be kept in a corked can, and poured in small quantities into a saucer, whence it is applied thinly with a flat brush. Two coats will generally be sufficient. It dries very quickly, glues together all the laps in the fabric, and shrinks it in drying).

An expeditious way of fastening the surfaces to the frame consists in stre c t ching them as tight as possible and then doubling them back around the spar, the flap so made is then fastened temporarily with pine; the first coat of varnish will glue the surfaces together, and the pins may be withdrawn if desired.

Although it is preferable that some of the rear portions shall be flexible, the supporting surfaces and the framework must be sufficiently stiff not to change their general shape when under motion. This indicates bridge construction for the framework and therefore the super-imposing of surfaces. Very little supporting or parachute action will be lost by this, for even when struck at right angles by the wind, Thibaut found that a square plane placed behind another of equal size, and spaced at a distance equal to the length of its side, still experienced a pressure of 0.7 that on the 9 9 front plane. The supporting surfaces will of course be arched in the direction of flight in accordance with the practice inaugurated by Lilienthal, who showed that they possessed at angles of incidence of 3 degrees, five times the lifting power of planes. It is not probable that success will be achieved in Aerial Navigation with flat sustaining surfaces.

PROPORTION OF PARTS.

In proportioning the parts the factor of safety for static loads should generally be 3, never less than 2, and preferably 5 for the parts subject to the more important strains. These are to be computed in the same way as they are for bridges, with the difference, however, that the support (on the air), is to be considered as uniformly distributed, and the load is to be assumed as concentrated at the center. It is not believed that it is practicable to calculate the strains due to possible shocks upon landing. They must be taken into consideration in a general way, but the utmost efforts will be made to avoid them.

The sustaining power will be calculated in the manner given by Lilienthal in Moedebeek's "Taschenbuch fur Flugtechniker und Luftschiffer". He does not, however, fully explain how to calculate the resistance; this consists of the "drift" or horizontal component of normal pressure, plus or minus the tangential pressure, and of the “head resistance” of the framework, of the motor if any, and body of the operator. 10 10 As an example how to compute this I may give the calculations for the “multiple wing” gliding machine of 1896, which was constructed before experiments, showed how the head resistance could be further reduced by adopting better cross-sections for the framework.

<u>AREA HEAD RESISTANCE, MULTIPLE WING MACHINE</u> .

Description No. Dimensions Millimeters Square Meters Co-efficient Resistance Equivalent sq. Meters. Front edge of Wings 10 2225 × 12.70 .28257 ½ .14128 Main Wing Arms 10 1956 × 12.70 .24841 # .08280 Ribs of top Aeroplane 3 1346 × 6.35 .02564 1 .02564 Posts of top Aeroplane 4 1829 × 12.70 .09291 # .03097 Posts connecting front Wings 8 1280 × 12.70 .12995 # .04332 Posts carrying pivots 2 823 × 19.05 .03135 # .01045 Curved prow pieces 3 914 × 24.50 .06717 1 .06717 Front bow braces 2 731 × 12.70 .01857 # .00619 Rear bow braces 2 841 × 12.70 .02136 # .00712 Cross struts bow & Frame 2 670 × 12.70 .01702 # .00567 Rear wing braces 4 2134 × 12.70 .10840 # .03613 Rudder braces 2 1219 × 12.70 .03096 # .01032 Rudder struts 2 548 × 12.70 .01392 # .00464 11 11 Wire stays 61 Meters 61000 × 1.27 .07747 1-½ .11620 Spring wire stays 8 meters 8000 × 1.27 .01016 1-½ .01524 Rubber springs 6 1300 × 1.00 .00780 1 .00780 Sundry projecting parts Say .01198 1 .01198 Aviator's body Say .46450 1 .46450 1.66014 1.08742

In order to calculate the resistance, we must first ascertain the requisite speed for support and the consequent “drift”. The front wings measure 13.34 square meters and carry all the weight, they are set at a positive angle of 3 degrees, for which the Lilienthal normal co-efficient # is 0.546. Using the well known formula W-k s v 2 # cos # in which W is the weight, k the air co-efficient, s the surface, v the velocity, # the Lilienthal co-efficient (0.11) and # the angle of incidence, and calling W=86 kilos we have for the support:

86=0.11 × 13.34 xv 2 × 0.546 × cos 3°; and as cos 3°=0.9986, we have for the speed: v=[???]86/0.11 × 13.34 × 0.546 × 0.9986 = 10.37 meter Whence we have for the front wings: Rectangular pressure 0.11 × 10.37 2 - 11.829 kilos. per square meter. Normal pressure at 3° 11.829 × 13.34 × 0.546 = 86.16 kilograms.

12

11 Lift at 3° 86.16 × 0.9986 = 86 kilograms.

Drift “ “ 86.16 × Sine 3° = 4.51 kilograms.

The Tangential pressure upon the front wings is zero at 3°. The “drift” on the rear wings, which measure 2.74 sq. meters, and were set at a negative angle of 3°, consists in the product of their surface by the rectangular pressure, multiplied by the difference between the tangential pressure, (Lilienthal's # #) which at this angle is positive, and the horizontal component of the normal (Lilientahl's #) which is negative at 3°, the latter being obtained by multiplying # by the sine of 3°. We have therefore:

Drift rear wings - 11.829 - 2.74 (0.043 - 0.242 × 0.05233) - 0.98 k.

The head resistance is the important factor, and depends upon the shapes which are adopted for the framing to evade air resistance and to secure low co-efficients. It has to be calculated in detail, and the table herewith given recapitulates the various elements of the area of head resistance of the multiple wing machine, reduced by co-efficients to an equivalent area for further calculations.

The rectangular pressure for a speed of 10.37 meters per second being 11.829 kilos per square meter, we have therefore for the whole resistance:

Drift front wings 11.829 × 13.34 × 0.546 0.54633 = 4.51 kilos

Drift rear wings 11.829 × 2.74 (0.043 - 0.0126) = 0.98 ”

Tangential component at 3° = 0.00 “

Head resistance 11.829 × 1.087 = 12.86 “

Total resistance = 18.35

As the speed is 10.37 meters per second, the power required to overcome this total resistance is:

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Power 18.35 × 10.37 = 190.28 kilogrammeters or 2.53 horse-power, and as the weight is 86 kilos the angle of descent as a gliding machine ought to be: Angle 18.35/86 = 0.2134 or tangent of 12°.

In point of fact the apparatus glides generally at this angle andfrequently at angles of descent of 10 or 11 degrees, this being probably due to an ascending wind along the hillsides, and fully verifying this mode of calculating the resistance.

In the "double-decked" gliding machine, in which the framing was better designed, the resistance was calculated at 14.46 kilos, and it absorbed a horse-power in gliding in still air. By employing still better cross sections of framework, and especially by placing the aviator in a horizontal position the head resistance could be reduced by at least one-third, but this particular attitude of the man would involve some risk of accident in landing, and is considered to be too dangerous to be employed in preliminary experiments. It will be noticed in the table that the resistance of the wire stays is given a co-efficient of 1-½, while theoretically, being cylindrical, their co-efficient should be about ½. This allowance is based upon experience, wire stays produce undue resistance, and this is probably due to the fact that they vibrate like violin strings when the apparatus is under rapid motion, and thus produce a greater resistance than that due to their rounded cross-section.

The power required will be seen to differ very materially from that indicated by the formula recently proposed in France, which is based upon the assumption that the total wing surface, in square meters, multiplied by the co-efficient of air resistance (i.e. the number of kilogrammes 14 14 carried by a square meter, at a speed of one meter per second) must at least be equal to the cube of the weight of the apparatus in kilogrammes; divided by the square of the power exerted by the motor in kilogrammes, or, K S T 2 = P 3 from which in our own case we would draw: 0.11 × 13.34 × T 2 = 86 3 , or or 8.78 horse-power, which is more than three times the power calculated by the method here given and tested by actual experiment and measuring.

It must be remembered, however, that the 2.53 and the 2 horse-power, which have been found sufficient to sustain 86 kilogrammes in the air, are the net horse-power absorbed by the gliding machines. When a propeller and a motor are added, it will be necessary to allow for the losses in efficiency incident to those adjuncts, and so provide about twice the power at the engine which is indicated by the resistance multiplied by the speed. A safe rule of approximation will be to allow that su ea ch nominal horse-power at the engine will sustain 20 kilogrammes, and that each kilogramme of the total weight of the apparatus will require 0.15 square meters of surface to sustain it at speeds of about 10 meters per second. When greater speeds become practicable and safe, the surfaces may be reduced below this so that at 20 meters per second they may be but about 0.05 square meters per kilo., instead of the 0.15 square meters per kilo above indicated, and this would permit reducing the 15 15 head area of the framing, but unless the co-efficient for the aviator's body was in some way reduced the resistance and power required would be greater, because of the higher speed.

These are the conditions and considerations which experiments with full-sized gliding machines, carrying a man, have thus far indicated as necessary to observe in order to achieve success with a dynamic flying machine provided with a motor. The most important of them are:

FIRST, that the automatic equilibrium and safety shall first be secured before an attempt is made to apply a motor, and

SECOND, that the apparatus shall be made as small and light as possible, so that the aviator may sustain its weight before taking his flights.

16

AIR PROPELLERS: By H.C. Vogt.

(Copy of a communication to London "Engineering", forwarded by Mr. Chanute, Oct. 13, 1908, see Bulletin XX, 43).

As most of the experiments performed with the air-propeller were brought before the British Association in September 1888, and published in the "Engineer" of September 28, 1888, and in the "Industries" of October 5, 1888, there is no reason to repeat all this here, but rather to present only the conclusions drawn from those experiments. A number of articles relating to this were subsequently published in most of the leading English technical journals, but all these are collected in the "Steamship" published at 2 Custom House Chambers, Leith, Scotland, and need not be reproduced either. The intention in this paper being only to present a general view of the most important facts.

When the idea of the air-propeller or revolving sails, for the use of ships was first originated, I imagined that it, working in the elastic air, ought to be more efficient than the water propeller; experiments proved, however, that the results came as near as possible to the same, that is: when a water propeller is at hand, yielding a certain thrust at a certain power, then a two-bladed air-propeller with 6 times the diameter and with its pitch reduced to something about the half or two thirds that of the water propeller, gives the same thrust at a somewhat smaller number of revolutions when the engine power is the same and the weather calm. 17 2 As soon as there is wind, this power is utilized, if the pitch of the air-propeller is changed accordingly (but of course only when this propeller is mounted on a ship, not when mounted on a balloon driving with the wind). The wind, when straight against the course, does some harm although not very much; suppose a storm blowing with the speed of 60 feet per sec., and let us also consider a speed of 60 feet per sec. given to the points of effort of the revolving sails in which the points the whole pressure is concentrated, then the result is exactly as when sailing 4 points from the wind with stationary sails; in the course of a year in our latitude, there is not a wind strong enough to prevent an air-propeller, driven with only one horse-power, to go straight against it, and

3 points from the wind its power is again. Let us for the sake of estimating the influence of the natural wind consider the same blowing with a speed V, and let the points of effort of the revolving sails possess a speed W, then in a two-bladed propeller, as in the sketch below (1), one blade will be working against a component V_c of the natural wind, while (2) the opposite blade will be working with the same; the aggregate influence on both blades will therefore be respectively a function of: $(W + V_c)^2 + (W - V_c)^2 = 2(W^2 = V_c^2)$ from which expression the considerable influence of the natural wind is seen. Even when the blades are passing the horizontal position, the influence of the natural wind is great because the normal pressure depends much more on the speed of the air, than on the angle of incidence, we only need 18 3 remember that an angle of incidence of 15° gives a normal pressure which is half as great as when the angle of incidence is 90°. Quite 80% of the different wind directions, when sailing in a circular path, are a benefit, whereas nearly 20% do some harm to the progress.

The best material for making an air-propeller is thin steel plate which enables the highest efiiciency to be reached, but it is often a mere chance to hit the best shape, a true mathematical screw surface is for instance very inferior, whereas a shape, such that sections through the blades form a feeble curvature, similar to that of an Albatross ' wing is very successful. The only feature in this shape resembling that of a screw is, that sections through the blades, parallel with the axis, should have their angles with a plane perpendicular to the axis, decreasing proportionately with their distances from the axis. It being so difficult to obtain correct shapes in steel plates, it is recommended to use canvas covered with oilskin in the following manner:— y - y is a yard fixed in its middle perpendicularly to a shaft A, the two sails S are stiffened by means of thin bobbers or booms, put in pockets in the sails, which are fastened to the said yard y -y by means of buttons working in a groove made in the yard; the pitch of the sails can be regulated by means of elastic sheets t, s are stays to support the yard y. The whole system is turned by means of a crank c an a connecting rod o; the vertical engine is indicated by E; the crank c must be perpendicular to the yard y , because the greatest influence of the natural wind will 19 4 just take place when the sails are perpendicular. For the sake of not straining the leeches of the sails too much, extra leeches are fastened between the noks of the said booms. A close fit between the sails and the yard y -y is essential, also the canvas should be doubled or tripled according to the strength required and covered with oilskin or coutchouc to make it as impermeable for the air as possible and as smooth as possible to reduce friction.

Propellers both in air and water work by creating a rarefaction by diminution of pressure or vacuum on the drag or rear side of their blades; this was demonstrated by leading a tube from the rear of the side of the blade of an air-propeller to the hollow shaft on which it (for this purpose) was mounted, the hollow shaft again communicating with a guage; nearly the whole thrust was thus found to result from the rarefaction on the rear side of the blade. The two agents in operation to create this rarefaction are, first, the suction from the rush of air over the drag or leeward side of blade. Second, the centrifugal force. As the pressure on the thrust side of a revolving propeller blade decreases from the tips towards the center, the air must, when the shape is correct, move inwards towards the lower pressure near the center with a speed proportioned to the difference in pressure between the outer and inner parts of a blade; the centrifugal force cannot therefore rarefy the air on the thrust side of a blade; but exactly the opposite takes place on the drag side of a 20 5 propeller blade, where the centrifugal force therefore assists in rarefying the air. Something like a little storm center is thus created in front of the propeller wherewith there is obtained, as it were, a grasp on the ocean of air in front of it, and a high momentum of air is brought in motion toward the propeller; part of this air passes through and is then acted upon by the thrust sides of the blades. The rarefaction is so intense at high speeds that the air is even literally drawn towards the propeller. An experiment relating to the influence of the rarefaction is published in the “Engineer” of Feb. 6, 1891, and more completely in the “Steamship” of March 2, 1891. It is there explained in what manner the efficiency of a small two-bladed steel propeller weighing 0.35 pounds, diameter and average pitch one foot, area 25 square inches, was determined, the same being found to ascend 200 feet into the air, when driven 70 revolutions per sec.

The determination of the efficiency is too intricate to enter on here, but one curious phenomenon, namely, negative slip, is easily demonstrated. The moment of Inertia I of the small propeller was 0.0012, and the angular velocity W at 70 revolutions per sec. was 440 ft. per sec., so that the energy ½ FW 2 became ½ × 0.0012 × (440 2) = 116 foot pounds, the whole of this energy could not, however, be used in flying up; because the propeller hovered at 13.5 revolutions, when the highest point was reached, corresponding to an amount of energy equal to ½ FW 2 = ½ × 0.0012 × (84.7) 2 = 4.3 foot-pounds, the whole amount of energy at 21 6 disposal for lifting the weight is consequently 116 -4.3 or about 112 foot-pounds. The propeller, weighing 0.35 pounds consumed, in flying up to a distance of 200 feet 200 × 0.35 = 70 footpounds, or about 63 per cent of the energy stored in the propeller; the mechanism through which the revolutions were imparted to the propeller consumed considerable work in friction etc; so it was found through experiment that a man had to develop about 130 footpounds in a single pull to give the propeller 70 revolutions per sec. The speed was easily measured and amounted to more than 100 feet per sec. especially while rising between 30 and 130 feet from the ground, which distance was passed in much less than one sec. whereas in accordance with the average pitch, equal to one foot, the speed should not have exceeded 70 feet per sec., the negative slip was therefore considerable in this case, when measured in relation to the average pitch , but when air-propellers were used for driving boats, and consequently had a comparatively greater resistance to surmount, the positive slip became often 3 times greater than with propellers in water ans still the efficiency was about 69%, thus showing that the slip had nothing to do with the efficiency of a propeller.

To prove negative slip in the air in another manner Major Elsdale undertook the following experiment:— A propeller was constructed with blades of such shape, that their thrust sides became parts of a plane perpendicular on the shaft, while the drag sides formed an angle with the thrust 22 7 side, the figure shows a section through a blade, the shaft being represented by A, the thrust side, perpendicular to the shaft, by t, so that its pitch is equal to zero; a propeller of this type gave a thrust nearly as great as when the thrust side t became parallel to the drag side s, the blade revolving as shown by the arrow.

When a propeller revolves quickly, the rarefaction often corresponds to a difference in pressure of several inches of water, and the currents produced by centrifugal force seem to prevent the air from striking the drag side, which it would do when negative slip occurs. Mr. Phillips had formerly mentioned the same experiment and explained how he drove a boat with a similar propeller and as the pitch of the thrust side was equal to zero, the negative slip was infinite in relation to that side.

When an air-propeller is required for any purpose, it has already been mentioned, that its di ?? am eter should be about 6 times the diameter of a propeller in water, determined for the same thrust, but area, pitch, revolutions, etc. can also be found directly from a model experiment by emeans of the following formula: two ships, or, in the case to be considered, two propellers are said to move with corresponding speeds H and h, when H/h = (D/d) ½ , where D and d are 23 8 similar lineal dimensions and H and h are the speeds of similar points on the propellers, for instance at their circumferences; under these conditions of speed, the thrusts T and t of the propellers, with areas A and a, are in the relation: T[???]t = A × H 2 [???] a × h 2 = D 3 [???] d 3 ; from A[???]a = D 2 [???] d 2 = (T/t) # results the important equation: 1) A[???]a = (T[???]t)#, and by means of D 3 [???]d 3 = T[???]t we obtain; D[???]d = (T[???]t) # so that H[???]h = (D[???]d) ½ gives?2) H[???]h = T[???]t # which is the second important equation; the two equations A[???]a = (T[???]t) # and H[???]h = (T[???]t) # are derived under the assumption that the thrusts vary proportionately with the area and with the square of the speeds, and we are now able to find the revolutions, area, diameter, etc. of any propeller, when we know the qualitites from the model. Let it, for instance, be required to construct a propeller able to yield a thrust of 1000 pounds which is the resistance of a ship of about 1000 tons at a speed of 4 knots; then to determine its number revolutions and the power required to drive it, a model experiment is necessary. To this end a two-bladed air-propeller quite 5 feet in diameter, 4 square feet area, pitch # of the diameter was driven by the power of a man to 4.5 revolutions per sec. and gave a 20 ft. boat a speed of 4 feet per sec. in calm weather, the resistance of the boat or thrust of the propeller at that speed, being 9 pounds, and the brake horse-power on the shaft became # horse-power which consequently corresponds to 45 pounds for each horse-power. The area A of the large propeller (which strictly speaking should move 24 9 at a corresponding speed to be of the same efficiency) is then:

A = a (T[???]t)# as the area a of the model is a = 4 square feet we get,

A = 4 (1000[???]9)#= 4 × 23 = 92 square feet for the area of the large propeller, intended for a thrust of 1000 pounds, and as the area of the model propeller is # of the disk area, the same must be the case with the larger similar propeller, whereby its diameter becomes 24 feet. The velocity in the circumference of the small propeller was 75 feet, the velocity in the large similar propeller will therefore be, H = h(T[???]t)# = 75(1000[???]9)# = 75 × 2.19 = 164 feet per sec. which corresponds to 2.2 revolutions per sec.

When the corresponding speeds for model and large propeller are termed h and H, and the thrust of the model propeller is 45 pounds per horse-power, then the power to drive the large propeller is, (1000[???]45)H[???]h, and as H[???]h = (1000[???]9) # = 2.19, we obtain the horse-power equal to 22 × 2.19 = 48, that is to say, the horse-power is 48, if the large ship moves with a corresponding speed to that of the model, which is 4 × 2.19 = 8.76, or quite 5 knots; as the large ship is only intended for 4 knots in calm weather, the power will be somewhat reduced; moreover, the efficiency of the large propeller is greater than that of the smaller, which also tends to reduce the power. Of greater importance, to however is the fact, that the resistance of the air varies at a much higher power than that of the square, especially when a 25 10 surface revolves round an axis in its own plane (when the speed of the points of effort of a surface, revolving round an axis in its own plane, equals that of the same surface, when moving after a straight line perpendicularly on its own plane, then the resistance of the revolving surfaces is about

3 times greater on account of the rarefaction produced through centrifugal force. The resistance also increases more than proportionally with the increase of the area when the speed is unaltered; it is not difficult to take these matters into consideration, but it makes the formula more complicated than is suitable for this paper; let it therefore be sufficient to say that the power in this case would be less than 40 horse-power and 2.2 revolutions per sec. would scarcely be reached at that power with a greater diameter than 20 feet.

Several experiments were made with boats furnished with revolving sials or air-propellers as explained in the article referred to; the largest of these was with a big steam launch belonging to the Royal Dockyard in Copenhagen and furnished with an air-propeller 20 feet in diameter. Any of them of course could have been used as unit or model for the example given, but when a model experiment is required it is not always convenient to drive a propeller with steam for that purpose. It is not difficult at all for a man to drive a very light boat to a speed of 4 knots or about 7 feet per sec. but the model air-propeller to be tested must be removed to different boats until one is found which offers the the required resistance at accertain speed.

H.C. Vogt, Holskeinsgade,31, Copenhagen.

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LAUDER TO BELL .

Calgary, Alberta, Canada, Nov. 9, 1908: — Having heard that you encouraged and experimented in Aerial Navigation, I therefore venture to submit to your valued consideration an idea which I happened to observe while experimenting with kites. Your are well aware that if an aeroplane could maintain its position in the air as steadily as a well constructed kite the science of flying would be almost solved. Then the question what keeps its flying so perfectly; the reason I saw for it was this, that the power as applied to the kite was not only in a forward direction but also down. Now if the flying line imparts a force that is also down as well as forward as illustrated in drawing I, why not put an engine and propeller, the propelle? exerting its force in precisely the same direction as the flying line in drawing No.II. What I base my theory on is this, that as far as I can gather that in the latest aeroplanes for example the “June Bug” of Mr. G.H. Curtiss, the power is applied parallel or nearly so to the planes.

Now if a kite was to be flown you would not attach the flying line to “K” in drawing I, you know that the kite would under no circumstances fly, yet you are applying the power on a parallel to the plane. But if you wished a successful flight you would fasten the flying line, in other words the power, to the correct spot on the bridle. Then why should not a propeller placed so as to exert its force in the same direction as the flying line, do the same work and keep the kite afloat. I am writing you Dr. Bell from having heard that you are a firm supporter of Aerial Navigation and your highly valued opinion would be very much appreciated.

(Signed) Alfred E. Lauder

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BULLETINS OF THE Aerial Experiment Association

Bulletin No. XXIV Issued MONDAY, DEC. 21, 1908

ASSOCIATION'S COPY.

BEINN BHREAGH, NEAR BADDECK, NOVA SCOTIA

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Bulletins of the Aerial Experiment Association .

BULLETIN NO.XXIV ISSUED MONDAY DEC. 21, 1908 .

Beinn Bhreagh, Near Baddeck, Nova Scotia .

“The Little Mother” of the Association wishes all the Associates a Merry Christmas and hopes she may gather them all together at Beinn Bhreagh to celebrate the beginning of a Happy New Year which shall bring them all the success they desire and for which they have worked so hard.

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ILLUSTRATIONS .

EDITORIAL NOTES AND COMMENTS.

On December 11, Friday, Mr. Bell and Alexander Graham Bell Fairchild left here for Washington. Mr. Bell expects to make a short stay of a few days in Washington returning to Baddeck by way of Hammondsport. It is his intention to be in Baddeck shortly before Christmas.

Asst. Editor.

Aerodrome No . 5

December 9, 1908 :— The body section of Drome No. 5 is being completed so as to have the structure ready for any experiments that may be desired when an engine is available for use. The season is now so far advanced that it is extremely doubtful whether we shall be able to try it this year flown as a kite over water even should the Hammondsport engine prove not to be prohibitively heavy. We shall have it so arranged however, that it may be tried either over the water or on the ice. There is no reason why the Hammondsport engine should not be used with ice runners. One great advantage too of experiments over the ice would be that we could use a front control as in the Hammondsport machines, whereas it would not be safe, I think, to employ a front control upon a machine that is flown as a kite. A.G.B.

The Victor Kite .

December 8, 1908 :— I have been anxious to obtain some data concerning the efficiency of kites of the Oionos type, as this form of structure is to be employed in Drome No.6. We had a kite of this kind which had been very carefully made for the purpose of obtaining readings that would throw light 2 2 upon the efficiency of the surfaces of Drome No. 6, but unfortunately the kite was smashed before instrumental observations could be secured (see Bulletin XX, pp. 31, 33, 34).

Another kite on the same model, but more crudely constructed is partly finished, but we have no other Oionos kites of sufficient size to give us valuable indications. We had, however, preserved in the Laboratory as a model the old Victor kite, in which the front and rear cells were of the Oionos type. Indeed, historically, the Oionos kite was developed from the Victor kite.

While this Victor kite has been flown many times in the past, proving as its name implies, victorious over the other kinds of kite with which it was in competition, no instrumental observations have been made.

Unwilling to lose the opportunity of employing a good kite breeze, it was determined to-day to fly this old kite as the nearest approximation to the Oionos type available in the Laboratory. It was a beautiful sight to see the kite flying almost vertically over head. Our inclinometer was only able to record an inclination of 60°, and the altitude was considerably greater than this. The efficiency (that is the ratio of lift to drift) is more than twice as great as with kites of pure tetrahedral construction: How much greater, it is impossible to ascertain without a more exact knowledge of the angular altitude attained.

It is probable that the efficiency of the Oionos type will prove to be still greater as there is in that form no 3 3 uncovered framework. As the Victor kite had not been provided with a bow-line, it was found difficult to bring it down. Experience in the past, having shown that the kite would be subject to lateral oscillations of considerable amplitude when nearing the ground, it was thought best to pull it in to as short a line as would be consistent with steady flight, and then cut it loose. This was done and Mr. Bedwin, holding the kite by a short line, ran with the wind so as to reduce the strain upon the flying-line and then let go.

The kite came down very gently, but unfortunately near a fence. The wind rolled it over on the ground right into the fence so that it was smashed. It has been preserved for several years in the Laboratory, but has been smashed at last, and has made its last flight. A.G.B.

Baldwin's Experiments .

December 8, 1908 :— In spite of Mr. Baldwin's success in obtaining hydro-surfaces that will lift the Dhonnas Beag completely out of the water, when propelled by her own motive power, and in spite of the fact that he has conquered the difficulty of stability when out of water, he has not yet been able to obtain any measurements of speed. The moment he puts on his full power the boat practically leaps out of the water and then dives, doing what he terms, “the porpoise act”, and the power has to be shut down.

He has now been trying smaller surfaces with the object of lifting the boat out of the water without bringing the lower hydro-surfaces to the top of the water, but so far 4 4 no satisfactory measurements of speed have been obtained. Dec. 4 one set of surfaces collapsed almost immediately; then a pin upon the propeller axis sheared, crippling the propeller. Dec. 5 there was slush ice in the harbor, and from this cause, or from other causes, he could not get the boat to lift. Dec. 7 the harbor was frozen up, but he carried the Dhonnas Beag to the Laboratory wharf and launched her on the Bay. Still the boat would not lift, and the propeller shaft was twisted off.

Mr. Baldwin thinks that the failure to lift with the small hydro-surfaces employed is due to the resistance of submerged horizontal struts of aluminum tubing. These struts were left in because a very little lift of the boat would carry them clear of the water. He thinks, however, that their presence in the water prevents the boat from attaining a lifting speed with the small hydro-surfaces employed. He proposes to cut out these struts altogether, and expects that the boat will then rise sufficiently to clear the water, but that the small hydro-surfaces will not have sufficient lifting power to bring the lower set to the top of the water. He may then be able to let the boat go full speed and ascertain its velocity. It will thus be seen that Baldwin is trying to prevent his hydro-curves from coming to the top of the water by using smaller surfaces, so as to get a less lifting effect. The thought occurs that it might perhaps be better to provide the boat with a horizontal rudder or front control, operating either in the air or water by means of which the operator could steer the boat 5 5 so as to keep the hydro-surfaces submerged. A.G.B.

THE UPPER SURFACE OF HYDRO-CURVES .

December 9, 1908 :— When Baldwin's hydro-surfaces come to the surface of the water so that they progress on the top of the water instead of beneath a great disturbance of the surface water results or, as Baldwin expresses it they make considerable “fuss”.

I am very much inclined to think that the form of the upper surface of the blade is as important, if not more important, than that of the lower surface. We are too much inclined, both in the case of hydro-surfaces and aero-surfaces to consider the lifting effect as due to the impact of a current of fluid on the under surface of our blades, practically ignoring the effect of the upper surface. Now the fluid impinging upon the convex upper surface near its front edge tends to be deflected away from the surface at the middle part of the blade, and at the rear, thus creating a partial vacuum over those parts, inducing a lift from statical pressure below quite independently of any dynamical effect produced by the impact of the fluid below. I should expect that this action would be more marked in the case of hydro-curves than aero-curves on account of the incompressible nature of the fluid employed.

If the vacuum effect has a sensible influence upon the lift, the lift would be diminished when the hydro-curves come above the water, so that there is only air above them. Baldwin's hydro-curves lift the boat clear of the water until they come to the top of the water. This is followed by a dive. 6 6 Then the boat lifts again and again dives, etc., etc. This is what Baldwin means by “the porpoise act”.

He has also noticed that considerable “fuss” or water disturbance is produced when the hydro-curves come to the surface. In other words fsam is produced. Now foam is water mixed with air. If a partial vacuum existed above the blades, both air and water would rush in to fill the vacuum and thus occasion the foam.

It would be interesting to try the experiment of having a hydro-surface made which should be convex above and flat below, and then dragging it through the water with the flat surface horizontal.

Should any lifting effect be manifest it could only be due to the peculiar shape of the upper surface. We should keep our eyes open to what is going on above the blade as well as to what is happening below. A.G.B.

A SUBMERGED WHIRLING FRAME .

December 9, 1908: — Many experiments have been made to ascertain the lifting power of aeroplanes and aero-curves set at different angles to the horizon by means of turning tables or frames to which the surfaces are attached. Mr. Baldwin and I are now engaged in planning out a submerged turning table or frame to test the lift and drift of submerged hydroplanes and hydro-curves. A scientific instrument of precision of this character could be easily constructed and would doubtless give us important information applicable alike to aero-surfaces and hydro-surfaces. These plans as they mature will be described in subsequent Bulletins.

A.G.B.

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Telegrams from Members .

McCurdy to Mrs. Bell .

Hammondsport, N. Y., Dec. 4, 1908 :— Silver-Dart made four flights early this morning. Balance and control satisfactory. Feels to King's taste.

(Signed) J.A.D.McCurdy.

Baldwin to Bell .

Baddeck, N.S., Dec. 15, 1908: — Results still unsatisfactory. Ore hundred meters twenty-one seconds. Not clear of water. Engine feeble.

(Signed) Casey.

McCurdy to Mrs. Bell .

Hammondsport, N.Y., Dec. 17, 1908 :— Silver-Dart made two successful flights this A.M. Longest 1 ¾ minutes. Completed the turn but flew too low, disabling running gear. Too much wind to continue this P.M., but everything will be in readiness to-morrow morning.

(Signed) J.A.D. McCurdy.

Curtiss to Mrs. Bell .

Hammondsport, N.Y., Dec. 17, 1908 :— John made two flights to-day. One-half mile and mile. Dropped one wing in landing. Repairs easily made by Sunday when we expect Mr. Bell.

(Signed) G.H. Curtiss.

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LETTERS FROM MEMBERS.

Curtiss to Bell .

To A.G. Bell, Baddeck, N.S.

Hammondsport, N.Y., Dec. 2, 1908: — We have had two trials of the “Loon”, one Saturday the 28th, and one Sunday the 29th. The engine with our new domes runs all right. In the first trial, after going a few hundred yards, the propeller sheared off. We have been a little afraid of this and in fitting it up for Sunday we used a new fastener. We also opened the auxiliary ports to get more power. On Sunday's trial a run of two miles was made in a little less than 4 ½ minutes. The boats raised at the bow, but the sterns dragged, although after they got under headway there was very little wave motion. The engine was turning over about 1000 revolutions and driving an 8 ft. propeller. The experiment makes it apparent that it will take a great amount of power to get these boats out of water, as we now have perhaps twice more than would be needed to fly after getting in the air. Those hydroplanes you have been building begin to look good to us. We have not given up, however, as a little wind on the water is not at all prohibitive. We hope to try again with better success, even though we do not have the good weather we have been favored with. The engine has been transferred to the Silver-Dart, which is fitted with new chain transmission, gear pump, oiler, ten gallon gasoline tank and a new propeller. We are having quite a storm to-day, and are unable to do anything at the tent. We are ready, however, for the first opportunity. We sent three pages of “Loon” pictures for the Bulletin on Tuesday. Trust they reach you in time for this week's issue.

(Signed) G.H. Curtiss.

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Curtiss to Bell .

To A.G. Bell, Baddeck, N.S.

Hammondsport, N.Y., Dec. 8, 1908 :— The Silver-Dart made its first flights Sunday. They were so short we did not wire. The weather was very bad and although we had some calms, before we were finally ready the wind increased and we decided to run in the 1tent until a more favorable opportunity. In the first two trials we were bothered by not getting gasoline. The tank had had water in it. It was carelessness on our part in not having it thoroughly cleaned out. In the third start several hundred feet was covered. John got an opportunity to get the feel of the control. It is more sensitive, that is, it answers quicker than on the old machine. He thinks it will be just right after he gets used to it. Under separate cover, we are sending prints showing the start, the landing, and the motor, transmission and propeller at close range. Am having these three made up in a page for the Bulletin, and either John or I will send suitable description to go with it.

(Signed) G. H. Curtiss.

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McCurdy to Bell .

To A.G. Bell, Baddeck, N. S.

Hammondsport, N.Y., Dec. 9, 1908: — I am enclosing a short account of our experiments with the "Loon". Although short they may be interesting to incorporate in the Bulletin and supplement the photograph of the experiments, already sent you by Mr. Curtiss. I have sent a copy of the enclosed to Ernest La Rue Jones, Editor of Aeronautics and given him permission to take any facts from the article he wishes, to write up a story in his magazine at his request.

I suppose you have seen in the New York Herald an account of the trials of the Silver-Dart here on Sunday. We refrained from sending you telegram of successful flight because they were simply preliminary canters and of no account in view of what we intend to do. On Sunday we had three starts all of about 200 yards, the machine dropping of her own accord on account of insufficient theoretical speed in advance of the propeller. On Wednesday the 9th, we had an early trial with the change from last trial of open auxiliary ports. It was assumed that this would give increased speed to the engine and that perhaps the few more revolutions obtained would be enough to cause the machine to take the air. Unfortunately, however, before we had gone 150 ft. the machine showed marked lift without my realizing the fact with the result that the machine twisted around to starboard and an accident occurred similar to the one experienced by Casey the latter part of September. We find that we must have a stronger running gear owing to the increased weight 11 2 over that of the June Bug; also that the engine must have mechanical intake valves. This will necessitate a delay of two days, so on Saturday we expect to have everything in first rate shape. I have written Major Squier to this effect and extended to him an invitation to spend the week with us and witness the trials.

(Signed) J.A.D. McCurdy.

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Curtiss to Bell .

To A.G. Bell, Baddeck, N.S.

Hammondsport, N.Y., Dec. 9, 1908: — Have your letter of the 4th. I wrote Mr. Lahm about the monument funds. He stated that he already had some contributions. He also mentioned that it would hardly be possible to erect anything in the field where the accident happened, but that a monument in Arlington would be most feasible. I dare say he is right about this.

Am pleased to learn that you are going to Washington the middle of the month and hope you will find it convenient to drop off at Hammondsport. If not, would like to meet you in New York or Washington.

(Signed) G. H. Curtiss.

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Curtiss to Bell .

To A.G. Bell, Baddeck, N.S.

Hammondsport, N.Y., Dec. 10, 1908 :— Under separate cover we are mailing you seven pages of Silver-Dart pictures showing first trial. This took place Sunday, December 6th. Three starts were made. The machine left the ground each time, but only one real flight was made. We have been having a lot of trouble, things which could not be forestalled. To illustrate, we found it necessary to use non-freezing fluid for cooling the engine on account of the cold at the tent where the Silver-Dart is stored. We have been using a solution of chloride of calcium in our cars and adopted this for the flying machine. In one of the longer runs, the water in the radiator got very hot and expanded faster than the steam could get out through the vent in the top of the tank. The rubber hose connecting the engine with the tank burst open throwing this solution of chloride of calcium all over the engine and part of the surfaces, not to mention John and one of the boys who stook near. The slight scalding they got appeared at the time to be the only bad effects from the accident. When we tried to run the engine again our troubles began. It seems that this chemical has a great faculty of drawing moisture, and in spite of the fact that everything had been wiped over moisture gathered in the carbureter, on the spark plugs and in the distriubuter, thereby causing the current for the ignition “to wander” and also spoiling the mixture in the carbureter. We could not seem 14 2 to get rid of the water. As fast as we could wipe it off, it would appear again. We took the commutater and spark plug off boiled them in hot water and baked them on the furnace. This helped matters for the time being, but our troubles commenced again. A solution of muriatic acid was finally used to cut away the chloride, but not until we had fitted porcelain insulation on the distributer could we get things working right. This is only one of several experiences. This all happened last week. Our first opportunity this week was Tuesday morning. We were all up to the track before daylight. There was a slight fall of snow but very little wind. We had opened the ports of the engine to give a little more speed, as the 8 ft. propeller with its 6 ft. 3 in. pitch did not give quite enough speed with our 11 to 15 gear. It is always difficult to start a cold engine, but we had her going nicely in a short time after removing a few traces of that chloride an John mounted the seat for a long flight. As you know, it has been customary to hold the machine down on the track until a good speed was acquired. These tactics were repeated, but the machine with its increased speed of propeller refused to stay down, at least the rear part of it. It seemed as if he had hardly gotten under way before the rear wheels were up in the air. John did not know this and continued down the track with the front wheel only on the ground held there by the front control. A little side wind was blowing and before John discovered what was going on the machine had swung around sideways and broke off all the wheels. The skid construction, 15 however, came into play and saved the balance of the machine. New wheels are being fitted and we have taken this opportunity to fit mechanical intake valves on the engine. This will give us the desired speed of propeller without changing the gear. As you will note in the pictures, we are using the belt drive. No trouble has developed as yet. The chain, which we had, did not prove very satisfactory, although a chain transmission can be gotten up which will hold. I made pictures yesterday and will send proofs to-night. If you want them for the Bulletin let me know.

(Signed) G. H. Curtiss.

16

McCurdy to G.H. Bell .

To G.H. Bell, Baddeck, N.S.

Hammond p s port, N.Y., Dec. 14, 1908: — Just received your note of December 10th. I have already mailed Mr. Bell an account of the experiments here with the Loon, and a short account of the preliminary tests with the Silver-Dart. If these letters come in Mr. Bell's absence, open them up and take anything you want. We this morning had four flights with the Silver-Dart. We were already on the track at & 7 A.M., so as to get going before the wind came up. Three starts were made down the track in the usual manner, the machine rising gently from the ground after covering a distance of about 150 ft. The remarkable part of it is that no torque manifested itself, as in former machines. The Dart rose directly from the track without veering off to starboard, as is generally the case, and another curious fact is that the starboard hind wheel would invariably lift first, whereas to be in keeping with the torque theory the port wheel should have lifted first. These flights were all short, the machine dropping of her own accord. One flight was tried up the track in a reversed direction more as a matter of convenience in getting the machine back to the starting point than anything else. The engine is now fitted with mechanical intake valves and this means that she runs constantly without necessitating a change in the mixture after being once started, as was the case in the suction valves. The best propeller speed obtained was 808 R.P.M. It was anticipated 17 2 that with a pitch of 6 ¼ ft. the theoretical pitch speed would not be sufficient to give the machine life and our fears were realized this morning. We are now, however, constructing a new propeller of greater pitch, 7 ft. diameter and 22 degrees at the tip. The engine has power enough to turn over this greater load giving probably the same number of revolutions as we have now. This ought to increase our pitch speed to the required extent. A slight accident occurred after we had taken the machine back to the tent. It was decided there to run her once more to test accurately the number of revolutions, but shortly after we had started, cylinder No. 2 blew off, the same one as before. As, however, an extra cylinder and piston are already made this will necessitate no very long delay. Mr. Curtiss has determined this time to secure the cylinders to the crank case by the addition of some stronger truss construction. We hope very much that Mr. Bell will stop off here on his way from Washington to Baddeck. I think t w hat we have here, both the water and land experiments will interest him tremendously, and we may keep him long enough to finish up our tests here and accompany him to Baddeck for Christmas.

Wish you every success with the new Bulletin.

(Signed) J.A.D. McCurdy.

18

McCurdy to Mrs. Bell .

To Mrs. A.G. Bell, Baddeck, N.S.

Hammondsport, N.Y., Dec. 14, 1908 :— I have written Mr. Bell, both to Baddeck and Washington, all about our experiments here, and as I presume you will see the Baddeck letters, I will not repeat myself here. This morning, however, as I have already telegraphed you, we made four trials of the Silver-Dart, all very successful and promising. A slight accident to the motor will delay us for a couple of days, but by that time Mr. Bell will be here, we hope, and see what we really call "successful flights".

Tell Casey that we are fitting the Loon with two small hydroplanes 9 ft. long × 7" wide, with a curve of 1 in 15 placed with an angle of instance of 5 degrees 6 in. below the boats, one forward and one aft. Ask him if he thinks this will be O.K.

It would be nice if we could all be in Baddeck for Christmas, and I do hope we can get through here and all go down with Mr. Bell.

(Signed) J.A.D. McCurdy.

19 19

Frame of hull for the loon

Ready for rubber cloth covering

20 20 147550-T

First view of the loon

Last view of the "June Bug"

21 Legend ? xxxix p. 23 21

En route to the Lake.

Nov. 28, '08.

22 22

The “Loon”

Making ready for trial

Nov. 28, '08

23 23

Nov. 28, '08 The start.

Nov. 28, '08 Full speed

Returning to the deck.

24

A SHORT ACCOUNT OF OUR EXPERIMENT WITH THE “LOON”: By J.A.D. McCurdy.

2?

Hammondsport, N.Y., Dec. 9, 1908 :—As the Hammondsport members of the Aerial Experiment Association were only waiting for the completion of the new motor to be installed in the “Silver-Dart”, there was practically nothing to do in the flying game. The idea occurred to us on October 23rd to fill in our time by trying some experiments along the line taken up by the Baddeck members. It seemed that the boats, or floats, should rise out of the water while under way, the aeroplane would produce the lift and that perhaps the additional use of hydroplanes was unnecessary. As we had the old “June Bug” lying idle, just waiting to be used, it was decided to build two small floats large enough to support the total weight of machine and man, and place these boats under the “June Bug” in place of the running gear which was attached at that time for rising off the land. The expense of building these boats would be comparatively small, so designs were immediately gotten out to support a total weight of 850 pounds. We finally decided upon the following dimensions: 20 ft. over all, 18 in. beam, and six inches of free board. These boats were constructed skeleton-like, of California Red Wood, and covered completely over with rubber oil-cloth. Completed, they weigh 60 pounds each. They are spaced 7 feet apart, catamaran-like, and connected by fish-shaped trussing to the lateral cords and central panel of the "June Bug". The vertical rudder, similar to that used 25 2 in the "June Bug", was mounted directly at the stern of the catamaran, while the single surface front control was mounted directly from the bow, thus doing away with the usual cantilever trussing employed in our former machines. This gave a great saving in head resistance and also made the whole thing when finished look very compact and neat.

The engine used was the one originally designed for the "Silver-Dart". It is a Curtiss, 8 cylinder, 3 ¾ bore × 4 in. stroke, water-cooled motor, and is mounted midway between the planes, driving direct an eight foot propeller of 6 ¼ ft. pitch. The machine thus constructed was renamed "The Loon".

To transport "The Loon" from the aerodrome shed to the head of Lake Keuka, where two parallel wharves were built to serve as launching ways, a two wheeled cart was constructed upon which "The Loon" would balance, and by attaching a rope to the front end of the cart, the machine was easily hauled along the road.

On Saturday evening, November 28th, the first experiment was tried. The engine being started by Mr. Curtiss and the seat being taken by Mr. McCurdy, the machine started on its maiden flight. The exact push of the propeller at the time was not known, although it was probably in the neighborhood of 250 pounds. Hardly had the machine, however, covered 400 yards when the propeller shaft was twisted off, the propeller being thrown violently into the water. This concluded experiments for the day. The speed attained was 26 21 3 calculated to be 20 miles an hour. The experiment was of such short duration that data as to the lift of the aeroplane was not obtained. A new propeller shaft was soon constructed of solid material, instead of the steel tubing formerly used, and on Sunday afternoon, November 29th, the second trial was made. The wind was blowing directly down the Lake with a velocity of five or six miles an hour. The auxiliary ports in the engine which were closed on the former trial, were now opened up, and it was anticipated that the speed of the engine would be greatly increased. As before, Mr. Curtiss tuned up the motor and Mr. McCurdy operated. We had agreed to try running down the Lake with the wind and back again against the wind, to ascertain whether there was any difference in lift due to the wind. It seemed that after running about 100 yards “The Loon” obtained her maximum lift. By “shooting” her, (by suddenly elevating the bow control), the bows would entirely lift out of the water without any depression at the stern which would be the result in the case of an ordinary motor boat. We took a course a mile down the Lake, turning in coming back against the wind, thus covering a distance of two miles in 4 minutes and 26 seconds. This gives a speed of over 27 miles an hour. It was calculated by Mr. Selfridge that the speed required to lift the “June Bug” o ? f the ground was about 23 miles an hour, and although the weight of “The Loon” was very little more than the “June Bug”, still an increase of speed of four miles on 23 was insufficient to cause her to take the air. This seems to indicate that the suction of the water in holding down 27 4 the boat is much greater than was anticipated.

2?9

As we unfortunately could not allow the experiments with “The Loon” to interrupt trials with the “Silver-Dart”, it was decided to take the motor up the valley to the tent and start flying there as soon as possible. We hope, however, after we have gotten through with the “Silver-Dart” for this year, we may go back to “The Loon” and have another trial with an experiment that promises so much.

J.A.D. McCurdy, Sec. Aerial Experiment Association

28

EXPERIMENTS WITH VICTOR KITE .

December 8, 1908 :—The old Victor kite was flown this afternoon on a line a hundred meters long attached to the center of the front set of cells.

Weight of kite 11 lbs.

Weight of line 1 ½ lbs.

Total weight 12 ½ lbs.

Exp . 1 . The wind was found to be 18.05 miles per hour. The following observations in altitude and pull were taken.

Altitude

51

53

55

60

55

56

60

55

56

44

10 Obs. 545

Average 54°.5

Pull

60

90

80

75

30

40

45

55

60

85

10 Obs. 620

Average 62.0 lbs.

Efficiency 1.75

Exp . 2 . The wind was found to be 15.85 miles per hour. The angular altitude was too great to be measured by the inclinometer, which only registered 60°. To the eye it appeared that the kite flew almost overhead and all we know is that the angle exceeded 60° during most of the flight. The following are observations of altitude and pull.

29 21. ? 2 Altitude Pull Observed Assumed 60+ 65 45 50 50 30 60+ 65 50 60+ 65 35 60 60 25 60+ 65 30 60+ 65 20 58 58 25 60 60 50 60+ 65 45 588+ 618 10 Obs. 355 Average 62° .8. Average 35.5 lbs.

Assuming the angular altitude to be 63°, and the pull 35.5 lbs, the efficiency works out 2.75.

It would seem that 63° is a very conservative estimate of the altitude therefore I submit the following table:—

Assumed Altitude	Efficiency
63°	2.7
65°	3
70°	3.8
80°	7.7

General Remarks :— As a general result it is obvious that the efficiency of the old Victor kite is very much greater than the efficiency of kites of pure tetrahedral construction.

G.H.B.

(approved A.G.B).

30

BALDWIN'S EXPERIMENTS WITH DHONNAS BEAG .

3? ?

December 3, 1908 :— The dimensions of the new double propellers are as follows:—

Diameter 88“

Screw construction

Spoon blades

Pitch 22 ½°

Geared 8 : 20

Exp . 1 . The following are eight readings taken at different times during the running of the engine. The Dhonnas Beag was floating at the wharf throughout the following reading and was constrained only by the rope attached to the spring-balance.

120

140

140

140

150

160

140

140

8 Observations. 1130 lbs. Average 142.25

December 4, 1908: — (Morning) The Dhonnas Beag was tried this morning driven by propellers described in experiments Dec. 3.

Exp . 1 . Got away splendidly boat lifting with spark retarded. Upon opening engine up for trial of speed she rose quickly from bottom surfaces and showed some indications of doing the old porpoise act. The after set of surfaces collapsed almost immediately so no estimate of speed could be obtained. The upright struts buckled. We must get reefing action for smooth running. Angle of surfaces less than 5°.

F.W.B.

31 31 ?

2 December 4, 1908 :— (Afternoon). Reported by Asst. Editor . Tried Dhonnas Beag to-day with double propellers (see experiments Dec. 3 in this Bulletin). Baldwin turned engine over and boat commenced to gain way. The engine appeared to be turning over faster than the propellers however, which was found largely to be due to the shearing of a pin which connected the engine with the gears. The engine then, for some reason or other stopped. Again Baldwin turned her over and engine started up. There seemed to be no slip for a while and boat responded by jumping forward and into the air supported on her hydro-surfaces. Baldwin was unable to control boat while her hull was clear of the water. She seemed to have a tendency to do the porpoise act, although experiments showed clearly that great lifting power was there. Again the transmission slipped and it was evident that a pin had been sheared earlier in the experiments.

Conference at Headquarters building decided that as she was completely supported on her lower surfaces one-half the surface used should be sufficient to lift her, and that it would be advisable to try the small curved surfaces (with straight edges) again, arranging them as in to-day's experiments. Using only two superposed surfaces six inches apart. Then if boat rises until her lower surfaces come up to the top (as with the larger set) this will show that the surfaces are still unnecessarily large, and that still smaller surfaces should be used. G.H.B.

32 3? ?

3 December 5, 1908 :— On Saturday Dec. 5 tried Dhonnas Beag after 5 o'clock. Light was very bad and it was impossible to get estimate of velocity. Small hydro-surfaces used

similar to successful straight edged ones in every particular except the amount of surface (which was about ½).

Two sets forward, one set aft, angle about 4°. Blades superposed, two in each set spaced 6 inches apart.

Propellers 88 inches diameter, 22 ½° at tip, gearing 8: 24, curvature 1 in 15.

Boat lifted by bow but after plane would not support. On moving weight forward stern lifted more, but bow would not lift. Speed somewhere about 10 or 12 miles per hour. A skim of slush was on harbor. G.H.B.

December 7, 1908 :— Harbor frozen up. Dismantled Dhonnas Beag and re-assembled by Laboratory wharf. Hydro-surfaces as on Saturday. Same propellers etc.

Engine started off well but Dhonnas Beag would not pick up enough speed to lift clear of water. A great deal of fuss aft. Transmission failed, stopped engine found propeller shaft twisted off. F.W.B.

December 9, 1908 :— Tried Dhonnas Beag on harbor this afternoon. Took out an aluminum strut and after set and put in a hydro-surface blade making 3 on after set. Forward surfaces arranged as before. 7 surfaces were used, angle (same as before) about 4°.

Propellers .

88 in. diameter.

22 ½° pitch

24: 8 gearing

33 3 ?

4 Struts taken out ½ in. diameter, 15 in. long.

Boat lifted clear of water after going short distance perhaps 150 ft. Something gave way, shut off engine. After set of surfaces ripped up deck (had forgotten to lash them under hull). Forward sets buckled on bottom blades. Uprights failed sideways. F.W.B.

December 10, 1908 :— The Dhonnas Beag was towed across the Bay by the Gauldrie so as to carry on experiments in the lea of the land. Baldwin got aboard and started the engine. Before the Dhonnas Beag had time to gain headway the chain parted, and it was necessary to take her back to the Laboratory to make repairs. The chain being patched up the Dhonnas Beag was towed back to the other shore and Baldwin took his seat on board when the Dhonnas Beag commenced sinking rapidly. It was found that the boat had sprung a bad leak probably due to the contraction of the wood caused by the cold weather. G.H.B.

Dec. 15, 1908 :— Tried Dhonnas Beag to-day outside of the harbor, in the Lake. She did not succeed in getting up on her hydro-surfaces, which was probably due to the fact that it was too rough to give the Dhonnas Beag a fair chance. The Gauldrie was sent over to the far shore to see whether the water was smooth over there. It was found that conditions there were no better, however, so experiments were discontinued for the day. G.H.B.

Dec. 16, 1908 : Dhonnas Beag was tried to-day. There was little wind an d no sea yet boat failed to rise on her surfaces. The engine, though it has been firing on all four cylinders has been working far from well. This is the probable cause for 34 3? 5 yesterday's and to-day's failures to rise. Although it may be that the surfaces now used are inadequate. G.H.B.

35

PROPOSED PLANS FOR A MACHINE WHICH WILL TEST THE LIFT AND DRIFT OF MODEL HYDRO-SURFACES: By Gardiner H. Bell.

? ?

A small and concise machine for testing hydro-surfaces would be invaluable. A multitude of experiments to ascertain lift and drift could be made which would undoubtedly be of great value, both to hydrodromics and aerodromics. It is our intention to construct a machine for this purpose.

We have had in view two ideas upon which to construct the machine. In one case water could be passed through a transparent cylindrical tube, the surfaces themselves being held in such a manner as only to allow them to move up and down. There are some practical difficulties to this form of machine, however, and it is probable that one will be constructed on the ro a t ary type, the machine as a whole being on a larger scale than in the first proposition. As soon as definite plans can be decided upon work will be begun on such a machine. G.H.B.

36

THE OUTLOOK ON AVIATION: By The Asst. Editor.

? ?

M. Max des Mouceaux de Gyvray a French inventor has been experimenting at Caunes with a wing-flapping machine. Its stationary surface planes are elongated like the body of a bird.

M. Santos Dumont's new machine is extremely small and compact and can be easily carried on his motor car. It is a monoplane driven by a 20 H.P. Antoinette motor, weighing 58 Kilos. and turning up 1400 revolutions a minute. The entire weight of the machine is about 150 kilos.

M. Georges Besamcon, Secretary of the Aero Club of France, has proposed to raise by means of a National Lottery the sum of $100,000 to be devoted to the construction of a fleet of aeroplanes and navigable balloons for the National defence.

The second day of the annual meeting of the American Society of Mechanical Engineers closed last night at the Engineering Society's Building with an address on the “Conquest of the Air”, by Lieut. Frank P. Lahm of the United States Signal Corps.

A. M. Herring has asked for an extension of seven months. This extension will probably be granted.

Sir Hiram Maxim in a lecture before the Society of Art s of Great Britain took the British Nation to task for its small interest in aerial machines. He reproached them for being behind other first class powers in progress toward a solution of this form of locomotion.

37

2 Dr. George A. Spratt of Coatesville, Pa., has been experimenting for some time past on gliders. Dr. Spratt's present glider consists of two curved planes 20 ft. long built one above the other with two small planes each about four ft. long at either end of the lower plane.

The first annual exhibition of the Junior Aero Club of the United States will be held Dec. 18–26 at Madison Square Garden.

Major O. Squier is of the opinion that the use of balloons and aeroplanes for military purposes will deter nations from going to war and go far towards bringing about universal peace.

The Aero Club of France, in view of the fact that both Wright and Farman have fulfilled the conditions of the High Prize Contest, will double the amount of the prize and award half of the sum to each aviator.

The Signal Corps will ask of Congress at the coming session an appropriation of $500,000 sufficient to make Aeronautics a permanent feature of the American Army.

Santos Dumont remarked the other day that he has completely abandoned the idea of using a biplane; and is going in entirely for the monoplane, which he considers has immense advantages over the biplane.

Morris Bokor at a recent meeting of the Aero Club of America exhibited an interesting model of his own invention. The machine is of the triplane type; the two upper surfaces are rigid while the third and lower surface is flexible and divided into two halves. The framework which holds 38 3 the motor is suspended as a pendulum which operates then controls.

According to cable advice from Berlin it is proposed to establish professorships of Aviation at the Gottingen University and at several technical Colleges.

Signal Corps' Balloon No.XII has been shipped to Omaha for use at the Army's aeroplant there.

The following Notes have been Translated from L'Aerophile for December .

(The December Number of L'Aerophile contains a long and full account of the Wright Machine).

Farman has transformed his biplane into a triplane by the addition of another surface 6 m 50 broad by 1 m 50 long, weighing 25 Kilos. placed above the back part of the upper plane. To restore perfect equilibrium of the machine the area of the rear tail will be increased.

Maurice Farman , brother of Henri Farman, has a biplane with two seats side by side. A single central helix 2 m 50 turning 800 revolutions under the action of a motor R.E.P. with 10 cylinders, air-cooled which develops not less than 52 H.P. The machine is mounted on wheels. The trial will take place over M. Esnault-Pelterie's grounds at Buc and will be conducted by Maurice in person. The aviator will also make trials with a Renault aerial motor having 8 cylinders, being air-cooled by means of a ventilator placed at the rear. It weighs 170 Kilos. and develops 58 H.P. This engine has a special carbureter placed above the cylinders. 39 4 The spark is generated by a magneto. At a fixed point, under the control of MM. Lumet & Carpentier, this motor has run three hours without stopping.

Antoinette Monoplane IV . The trials set for this machine piloted by M. Welferinger followed one another rapidly and with brilliant success at Issy-les-Montineaux. On Nov. 16 at 10.30 A.M., the machine crossed the field, a distance of 700 m, at a height of 5 to 6 meters. On Nov. 17 five flights were made at heights of 200 and 300 meters. On Nov. 18, after having crossed the field at a height of about 3 meters M. Welferinger, to avoid wounding two municipal guards rose immediately to 6 meters and landed hard, close to the Malecot shed. The slight damages were repaired the same evening.

Wehrlé Aeroplane . M. Wehrlé, Director of the Thermes de Royat, proposes to put in the field an aeroplane placed on skids and wheels combined.

The Marquis d'Equevilly-Montjustin , a marine engineer has just commenced preliminary trials at Issy-les-Moulineaux. The machine is a multiplane the superposed panels of which, differing widely to the number of 12, are mounted on an original circular armature made up of steel tubes. The machine mounted on wheels is propelled by an helix 2 m 50 diameter placed in its center and driven temporarily by a motor of 7 H.P., which will be replaced by a more powerful one in future. The maximum length of the machine is 5 meters. Total area 25 sq. m.

40

5 The Triplane and the Biplane of Moore-Brabazon .

Obliged to go to South America and desirous of familiarizing himself quickly beforehand with the practice of Aviation M. Moore-Brabazon has just ordered from the Voisin Brothers a biplane like Farman's.

Witzig-Lioré-Dutileul is having an aeroplane put in condition and modified so as to better insure equilibrium. He will resume trials at Issy-les-Moulineaux when the machine is in condition.

Zipfel Aeroplane . The first appearance of this biplane took place on Nov. 19 at Grand Camp, near Lyon. Operated by its constructor the machine left the ground after several attempts. During its flight it became heavy by the head and came down bow first. Slight damages to the front control were soon repaired after this first encouraging journey.

The Monoplane “R.E.P. 2 bis” gained the third prize for 200 meters given by the Aero Club of France on Nov. 21. Rising at 11.12 A.M. the monoplane R.E.P. 2 bis descended 316 m distant from point of departure. The machine during the flight maintained perfect s a t ability hovering at a height of from 4 to 7 m, in spite of a wind which blew in irregular puffs averaging from 6 to 8 m per second measured by the anemometer. Mr. Chateau operated the machine.

The prizes for 200 meters, established by the Aero Club of France, for the purpose of encouraging the construction of new machines offering the inventor a reward for their first success, were three in number.

41

6 The first was won by Delagrange on March 17, 1908, at Issy, by flying 269 m 50.

The second was won by Bleriot, June 29, 1908, also at Issy, not measured, but estimated at about 700 m. M. Chateau, operating the R.E.P. 2 bis has just won the third and last of these prizes.

Previous to this the Aero Club gave in the same way the following prizes:— One for 60 m gained by Santos Dumont Nov. 12, 1906 at Bagatelle. In this test Santos Dumont covered a distance of 82 m 60. Again, the same day, trying for a prize for 100 m Santos Dumont succeeded in going 220 m. In 1907 Henri Farman won the prize for 150 m, on the 26th of Oct. by covering a distance of 770 m at Issy.

Bourdariat Aeroplane . We learn that M. Edouard Bourdariat has constructed at Levallois-Perret, an aeroplane which combines the features of both Langley and Chanute type machine.

The fore part, on the order of Langley's machine, is 9 m 50 in breadth by 1 m 50 in length.

The center part, which embodies Chanute features, is 7 m 50 in breadth by 1 m 44 in length. Area of this center portion 22 m 50.

The after part (Langely type) measures 6 m 50 in breadth and 1 m 50 in length.

The whole is sustained on supports 10 m 50 in length. No definite information as to the mechanical side of the machine has been yet obtained.

42

7 M. G. Pasquier's Aeroplane :—

The old champion cyclist of Rheims, M.G. Pasquier will soon commence experiments upon a new aeroplane at the field of Chalons, near Saint-Hilaire-le-Grand.

The machine will be of the biplane type, with monoplane tail (40 m surface), driven by two helices 2 m in diameter. The machine is mounted on wheels. The motor to be used is of 60 H.P., weighing only 40 kilogms., of which M. G. Pasquier is the inventor.

FOREIGN AEROPLANES.

Caters' Triplane . Baron de Caters has made, on the last of October, with his triplane, constructed by the Voisin Brothers, a series of fully satisfactory trials. He has reached a height of 1 m 50 above the ground and has hovered at this height for a distance of 800 meters. M. de Caters intends to construct a second machine of the same type as the former. He will continue his experiments in the course of the next week at a place situated near Anvers. The motor used on the machine is a Vivinus. The engine turns over 1250 revolutions and devleops about 58 H.P. In order to diminish the number of revolutions of the engine the number of revolutions of the helix will be increased thus the diminution of the power will be compensated for by a better utilization of the helix.

German Aeroplanes . The construction of an aeroplane resembling the Wright ma?
ine has just been completed at Tempelhof, near Berlin, by M. Meschner a well known engineer. The frame is constructed with aluminum tubes mounted in steel. 43 8 A powerful motor is installed. It operates a helix of three blades. The machine, it is expected, will make a speed of 60 Kil. an hour. The trials of the motor have been very satisfactory. The aeroplane will make trials in a field near Templehof. The completion of Major Parseval's aeroplane will be effected at about the same time.

Karl Jatho , a German Aviator, will soon try his aeroplane at Hanover. The machine will have installed a German motor, Koerting, developing 35 H.P., four cylinders, water-cooled, total weight 80 kilos.

Aviation in Germany . The Council of Administration of the Syndicate of Charbons of Westphalie has voted 20,000 marks for the construction of an aeroplane.

The Aeronautical Association of Bas-Rhin at Essen, has formed a Society of Students of Aviation to construct a machine according to new principles.

The Herring Aeroplane . The delay of experiments with the Herring aeroplane for the competition instituted by the Signal Corps of the U.S.A., expired November 13. Mr. Herring on October 28 tried his machine and his debut was rather unfortunate. After a flight of 100 m at Hempstead Plains at Long Island the machine was wrecked. Mr. Herring is going to reconstruct his engine.

A Society of Aviators in England . A new Aeronautical Society to encourage the construction of aeroplanes and promote experiments in Aviation formed in September last, already has 350 members. Several well known French Aeronauts have already subscribed.

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9 Accident to Bellamy Aeroplane . M. Bellamy, a Frenchman, who for several months past has been experimenting with an aeroplane near London at the town of Richmond, met with an accident in one of his trials after starting from the top of a hill. At the start the machine took the air driven by a 6 cylinder motor and descended rapidly. The aviator seated right behind the helix was badly bruised and the machine was put out of commission.

The “Grade” Triplane . The triplane of Mr. Grade of Magdebourg which has installed a 6 cylinder engine developing 36 H.P. weighing 54 Kilog. has made a number of trials. The machine, which is of 25 m surface, weighs 150 kilog. Mr. Grade now has a new machine at Mulhouse of the helicopter type. It can rise to the height of a meter and traverse a distance of several meters. The inventors hope to compete for the Lanz prize.

A Texture for the Supporting Surfaces of Aeroplanes .

At a meeting in Germany the following fabric was considered superior to anything yet known for aeroplane surfaces. The quality of the cloth was china-gras (Urtica nivea) which weighs 200 to 220 gms. per sq. m and costs 1 mark 80 about (2 fr 25) per sq. m. As to durability, minimum resistance, tightness, weight and price it has no equal.

Trial of a great Ornithopter . A communication from Brussels received Novemebr 16 tells us that the ornithopter belonging to our distinguished brother M.A. de la Hault, Editor of “La Conquete de l'air”, which was tried in the 45 greatest seclusion on the Plains of Berkandael, near Brussels, rose from the ground. It is driven by a 100 H.P. Motor.

New Italian Aeroplane . At Novara, the Gemma Brothers will commence the trials of an aerial machine which they have named “Aerocurvo”. This machine is 9 m long and 7 ½ m in width. Ins a t alled in it is an Anzani motor weighing 91 Kilos. turning over at 1500 revolutions.

The Russian Government and Aviation . It seems that the Russian Government has given an order for the purchase of an aeroplane from the Wright Brothers. The Czar, who is personally interested in Aviation, has demanded more funds from the Minister of War for this purpose. G.H.B.

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BULLETINS OF THE Aerial Experiment Association

Bulletin No. XXV Issued MONDAY, DEC. 28 , 1908

ASSOCIATION COPY.

BEINN BHREAGH, NEAR BADDECK, NOVA SCOTIA

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Beinn Bhreagh, Near Baddeck, Nova Scotia.

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THE NEW EPOCH IN AMERICAN AERONAUTICS. SECOND PART. By Karl Dienstbach.

One of the most remarkable appearances in American Aeronautics of the present day is the Aerial Experiment Association. Formerly there has been given information in this journal about the so interesting and well subsidised labors of Dr. Alexander Graham Bell, and his tetrahedral principle of construction for flying apparatus. During all the past years Dr. Bell has endeavored to turn one of his gigantic tetrahedral kites into a motor driven aeroplane. However, he found this task so difficult and complicated, especially as he wished to proceed systematically and to leave nothing to chance, that it was evident that outside assistance would be necessary. He chose, to assist him, two young engineers who has just graduated from the Toronto University in Canada, Messrs. McCurdy and Baldwin. The former had been for long years a friend and almost a member of Dr. Bell's family — the house of his father was next to Dr. Bell's country place at Beinn Bhreagh, near the town of Baddeck in Nova Scotia, Canada, and Mr. Baldwin was introduced by him. Both are youthful, vigorous types of the Canadian Scotch as it has preserved itself surprisingly pure in the north of the New World. The real language of the country there is Galic, an old Celtic. Dr. Bell, himself, is of Scotch descent. On his search for the right men to construct his motor, Dr. Bell could finally hardly fail to become well acquainted with Glen 2 2 Hammond Curtiss. This latter, a son of the well-to-do old picturesque country town, Hammondsport, in the north of the State of New York, near Buffalo and Niagara Falls, at the beautiful Keuka Lake, of which the high shores, covered with vineyards and woods, with the substantial stone built wine cellars, remind one of the Rhine, has turned within a few years a small shop for bicycles into a thriving factory for motorcycles, in the three buildings of which about 90 workmen are employed. In its ideal seclusion, Hammondsport has just proved itself an especially fertile ground for aeronautical ideas, and the light and strong Curtiss motor was early valued as a motive power for airships. Thus was driven by a Curtiss motor the first California Arrow, Capt. T. Baldwin's creation, and soon these motors were sought, not only by the latter's imitators, but also by many would-be inventors of dynamical flying apparatus. Curtiss is endowed with that happy practical insight, which let him find the simplest construction and the most serviceable measurements; His motorcycles have proven to be solid and speedy, and excel, especially in an original belt transmission which is also to be tried out in the newest flying machine; a built up leather belt touches only both sides of a conical groove in the pulleys, and, therefore, a slip is not liable to occur even on small pulleys.

Dr. Bell, in the summer of last year, had summoned Mr. Curtiss to Beinn Bhreagh, the scene of the newer tetrahedral experiments, and hardly the latter had made there the acquaintance of McCurdy and Baldwin, when Lieut. Selfridge arrived. Lieut. Selfridge was a young officer of artillery 3 3 who had made a special study of aeronautics, and had therefore been sent from Washington as an official observer of Dr. Bell's experiments. He was received with open arms. Dr. Bell's gifted wife suggested then that all the above named should legally organize themselves into an “Aerial Experiment Association”, in return of which she would give a considerable sum for the sole purpose to put any sort of dynamical flying machine , as fast as possible, into the air. Such good advice was immediately taken and in the beginning of winter the whole new “Association” followed Mr. Curtiss to Hammondsport where he was called back by his business.

Dr. Bell's family was included, and so the “Capitol” of Hammondsport, yonder steep hill surmounting the whole village, which is crowned by Curtiss' house and the factory buildings, became a most unique stronghold of aeronautical enterprise. For a long time past the Mecca of more or less adventurous inventors, it now became an aim for the pilgrimage of more serious promoters of the art of flying, Augustus Post and Prof. Wood might be named as visitors for several days, and Herring and Manly belonged to the pilgrims' flock of the Aero Club of America which was drawn there by the flight for the prize of the Scientific American.

In Nova Scotia the Association had taken up Prof. Bell's own experiments. Lieut. Selfridge made there a long flight above water, aboard the gigantic tetrahedral kite “Cygnet”, which was towed by a steamer. Then it became apparent that the accumulation of so many thousand cells, which of course necessitated the placing of hundreds of them 4 4 directly behind each other, marred the lifting effect. Whole masses of cells which seemed hardly within the reach of air current appeared to be solely useless ballast.

On the working program for the winter in Hammondsport, therefore, was placed the search for a more advantageous grouping of the cells, the program being carried out mainly by the younger element. Gliding experiments were suggested, which were taken up with enthusiasm. Faithful to the aim set by Mrs. Bell, viz., to arrive at real flight on the shortest route, there were soon rather eclectic proceedings, and thus a gliding machine was adopted, which came next to that of the brothers Voisin in France. In appearance it resembled the Herring-Chanute apparatus, but the most important part of that, the automatic steering tail, was replaced by a rigidly connected surface behind the wings. As wind vanes, small vertical planes at both sides behind the wing tips, were employed. The results of these gliding experiments resembled those of most of the epigons of the old able school. The obligation was missing to overcome the initial difficulties. And the light motor showed itself in too aluring a proximity. Lilienthal, Herring and the Wrights attained such enjoyable results, just because for the time being they were not at all able to see more than the gliding problem and were therefore given to the subject with heart and soul. It is rather an impediment for true progress, that gliding is more difficult in the beginning than dynamical flight, for the simple reason that it becomes so uninteresting and laborious in a calm, that “flying in the wind” is simply a necessity. Nobody has as yet 5 5 approached that degree of mastery which Lilienthal once acquired by an iron perserverance in practicing with his primitive apparatus. What would <u>he</u> say to-day at the almost superstitious fear with which Farman and Delagrange are trying to evade even the least breath of wind. He, who once judged Maxims' machine so severely only “because it could not fly even in a light wind”! It is worth while, by the way, to remark that Lilienthal's apparatus, exactly on account of its primitive simplicity was decidedly superior to the Farman type. The dihedral angle of the supporting surfaces and the large rear cell of the latter render its flight in a calm unusually easy, but are such a hindrance in a wind, that with those machines it becomes altogether a riddle, how and when the art of flying in a wind (without which a lightning fast flying machine has less practical utility than the smallest slow motor balloon) will be learned! For Farman's machines this seems altogether impossible, because, for instance, the enormous leverage of the rear cell would paralyze the efforts of the front control to fight the wind gusts. Lilienthal's surfaces were simply neutral, without help and without hindrance, for the stability. His displacement of the center of gravity was a too tiresome method of balancing, but nobody has yet flown so boldly and so grandly in a strong wind, as he, and the brothers Wright needed only to replace the shifting of heavy masses by the lightning fast movements of steering surfaces to turn the Lilienthal machine in principle into a far greater perfect flier, indeed, their ambitions were only attained because of a Lilienthal-like perseverance!

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6 If the machine is thus based on the right principle, it should indeed be possible to acquire mastership without gliding by endlessly repeated short flights in winds of steadily increasing force, and so we may hope the best for the future of the Aerial Experiment Association in Hammondsport, because logical developments of its eclectic method has led it finally to the veritible Wright type! But let us return that interesting development!

The above mentioned Hammondsport glider was smashed in the end by an awkward landing, in attempting to fly it as a kite, and was not again rebuilt. Instead, the “Red Wing” was constructed (Dr. Bell has given pretty characteristic names to all his apparatus — they indeed facilitate classification).

This was really principally an imitation of Farman's then so triumphant a machine. The only difference being that according to an idea of Mr. Baldwin's, the upper surface, (across the direction of flight) was curved upwards, and the lower one downwards. Near the wing tips the mutually approaching surfaces had therefore to be made narrower in the direction of flight, and thus resulted a natural approach to the shape of a bird's wing, which was still accentuated by triangular wing tips. This form has been steadily preserved, and indeed justly, as it seems, for it prevents partly the disturbing lifting effect of a side gust, which at the worst would have a sidewise shoving effect, which latter might just neutralize that one-sided lift because it 7 7 might call for a certain lift on the opposite side in return.

Like Farman's, was a rear cell but of one surface with a vertical rudder, hinged on its top. It was smaller in proportion and was much lower than the principal cell. The wing profile was peculiar in the shape of Turnbull's S curve. (The curve reversed in the rear).

It had been adopted eclectically in the interest of stability. This machine, mounted on sleigh runners, was tried on the ice of the frozen Keuka Lake. It was provided with that 40 horse-power, air-cooled, Curtiss motor which had been judged so favorably by experts at the second exposition of the Aero Club of America, and has been illustrated and described in the article of last year's issue of this journal. Indeed, the fear expressed at that time that air-cooling would not be sufficient for full power was found to be only too well founded, with this accumulation of eight cylinders: In flight full power can be counted upon only for about three minutes. Taken over from the French was also the mounting of a small propeller directly on the motor shaft. This machine unexpectedly flew up and away during a trial which was only to test its dirigibility on the ice. At a second successful flight, there being no method employed to control the lateral stability, the machine capsized, fell down sidewise on the ice and smashed. Officially, Lieut. Selfridge had been its builder. A second machine, the “White Wing”, succeeded it immediately with the great innovation of the “wing tip control”.

The twisting of the Wrights' wings was here imitated in principle, but two special horizontal rudders on the ends 8 8 of every surface were substituted. This had the great advantage that there rudders in normal flight were set horizontally while they thus did not participate in the flying angle of the supporting surfaces, in action the left rudders could be set positively at exactly the same angle as the right ones negatively and vice versa. The mechanism always operated in this way, and thus there resulted no turning tendency from the righting tendency, like with the Wrights, which would have had to be compensated by the vertical rudder. In a clever way these safety surfaces were worked by the inclination of the upper body of the sitting operator. If the latter would incline, like Lilienthal, but with hardly the tenth part of the effort, towards the side which happened to be too high, he would set instantly these surfaces at the corresponding angles by means of a fork which surrounded his body, and the machine would at once right itself again. Like Farman, the steering wheel for the vertical rudder was used at the same time to work the frontal horizontal rudder by being shoved fore and aft. The “White Wing” was provided with three wheels like those used for the Curtiss motorcycles. They could not set themselves automatically in the direction of flight (in relation to the ground) like those of Far ? m an, and also did not have any springs. In turn, though, they were considerably lighter, and the center of gravity of the machine could thus also be brought into closer proximity to the ground. The shortcomings mentioned have, however, never been felt before, although the practicing grounds were rather unfavorable, fields and meadows, with trees on two sides and a railroad 9 9 track with telegraph poles and wires on the opposite side, and half crossed by a very disturbing vineyard, in which an emergency landing would have been excluded. It was formed by the broad valley which is the continuation of the elongated (and farther up forked) Keuka Lake. Hammondsport itself occupies its left side at the Lake shore, and the practicing grounds are over three kilometers distant from the town. The necessary first run was taken on a rectangular race track with rounded corners, which though more resembled a German “fieldroad”. Therefore, it was found necessary to place a wheel under the framing of the front control which would be moved by the steering wheel simultaneously with the vertical rudder, because the latter alone was not efficient in keeping the apparatus on the track during that preliminary run. It should yet be mentioned that the uprights posts between the surfaces were sharpened after scientific rules, and that all details of construction were of a very practical nature such as sheet steel connections for the wooden posts etc., all these machines were unusually light for their size. The “White Wing” was tried successfully several times by Selfridge and Curtiss, but came to grief at the first flight Mr. McCurdy ever took, because the latter leaned out of the fork of the tip control and thus could not prevent the machine in the end from striking the ground sidewise with full force and be smashed to pieces. He was fortunate enough to escape with but a slight wound on the arm. The “White Wing” had been officially the work of Baldwin and now came Mr. Curtiss' turn. His design was very similar, but the execution

was more solid and deliberate. 10 10 He left off, after having benefitted by experience, the vertical surfaces of the rear cell. Thus he attained greater speed, and when finally all of the cloth surfaces were varnished, the lifting effect was considerably increased. It has already been told, in a proceeding article by Moedebeck, how Mr. Curtiss won with this machine the beautiful silver trophy of the Scientific American on the Fourth of July, by a flight of one kilometer. The machine has made since then many more and longer flights, and in the worst case has only been slightly damaged. During some repairs, though, it passed through significant development. During the prize flight the position of the center of gravity was not correct, the horizontal rudder had to be depended upon to continually counteract the “bucking up” of the machine, by a negative angle. On the day after the prize flight the first complete turn was at last successfully negotiated, but a second short turn would have had to follow it at once to clear that fatal vineyard, and for that too much speed had been lost during the first turn, thus the tip control lost its effect, and the machine in its inclined turning position begun to glide down sidewise, and the right wing and also the front end were damaged. The latter was then lengthened and the seat for the pilot could be placed at the same time a little further towards the rear, to thus gain advantageous leverage of the inertia against tipping over. The frontal horizontal rudder was at the same time somewhat increased in size. Later the horizontal tail surfaces were taken off with another resulting gain in speed and capacity for control, without any loss of stability.
The surfaces 11 11 were then varnished once more and the machine, alas, lost its flying power. That unfortunate dispute about the question: “plane or curved suraces” appears really very superfluous if one has seen how the bending straight of the too light ribs with the increased tension of the cloth resulting from the re-varnishing, had turned the curved surfaces into straight ones, disinabling the machine to rise from the ground. New ribs were then manufactured with a still more efficient single curve without the S curve, glued from four blades in place of three, and therefore preserving better form. Thanks to a favorable principle of construction, these ribs only needed to be inserted into pockets of the cloth from which the old ones had been removed, and the surfaces were again possessed of a most efficient curvature.

The motor was then provided with an extra lubricating apparatus, which allowed the cylinders to flood with oil and which kept them cool considerably longer. At the first steering test with all these improvements, even the last horizontal surface was torn off the tail and the machine would now fly more obediently than ever. It was then simply natural, to take off the useless empty frame of the rear cell altogether and to hold the vertical rudder directly by means of four bamboo poles, the vertical rudder being made shorter and higher at the same time. Finally the plan of the machine was completely in accordance with all the best features known to ensure steady flight, one important feature being the increased power of the first control. It was made of two big superposed surfaces and at the sam time shifted farther towards the front. These changes made it 12 12 easier for the trained operator to maintain stability, in that it became much more obedient, and finally, on the 29th day of August, Mr. McCurdy was able to describe with the machine a closed figure eight, covering a distance of more than three kilometers, in three minutes, and at a height of some eight meters. He landed at the starting point in the middle of this figure. There was a light wind. At the last practicing flights, heights of 20 meters and more had already often been reached. Thanks to the tip control and the narrow wing tips, much shorter turns may be made than are possible for the Farman type, for which latter the practicing grounds in Hammondsport would probably be altogether useless. A new improved machine is almost completed. This was named “Silver-Dart”, because its surfaces are covered with Capt. Baldwin's new silver grey rubber impregnated silk which weighs much less and is absolutely air-tight. The wings are somewhat narrower and over two meters longer. By their slender curve they resemble the wings of a gigantic albatross. Of course, two passengers are here counted upon. The construction is extremely elegant. Skill and experience gained were put to use. Of course the rear cell is now absent, and the rudders have become as powerful as possible, both big surfaces and both mounted at the end of long lever arms. Practically this is a “Wright machine”, only with several good original features. A water-cooled motor of 50 horse-power with radiator is under construction for that machine, which, with all accessories and a passenger, is to be placed into a fish-shaped central body. The surface of the four triangular tip controls 13 13 has likewise been increased. Trial flights will soon take place. Officially, this is Mr. McCurdy's machine, and that with so much the more right, as only Curtiss was there to help, as Selfridge has been recalled to service at Washington, for the tests of the Government air craft, and Dr. Bell, with Mr. Baldwin has again eluded the summer heat by going to Nova Scotia. Good work has also been done there. Numberless scientific ascensions of tetrahedral kites led finally to a shape whi? was adopted for a giant tetrahedral flying machine, now under construction. The design is very different from “Cygnet” for between the groups of cells empty spaces have been left to allow free access to the air currents everywhere. On account of the great natural stability of tetrahedral flying apparatus, there is needed only a horizontal rudder in front and avertical rudder behind the propeller. This flying machine is intended to be towed by a steamer as a kite, and motor and propeller will become operative only after it is in the air.

NB. At the request of the Secretary, this article was tranlated from the German by Mr. Dienstbach, so it could be incorporated into the records of the Association.

J.A.D. McCurdy.

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Blanchard to Bell .

To A. G. Bell, Baddeck, N. S.

Baddeck, N.S., Oct. 24, 1908 :—As I promised you, I send you a verbatim extract from that famous book of mine. “Mr. White” is one of the inhabitants of the days of A.D. 1837 and the man using the “first person singular” is the person who is a survivor of A.D. 1899 telling his experiences after he awoke in A.D. 1937:— only 38 years of a jump. That thought of “concurrent inventions” I know of to my own sorrow. I once in Montreal applied to a patent lawyer to patent the glass ball and socket castor. Imagine my surprise when he told me he had patented it for another man within three months past, which was I found, a fact. This is an invention whose principles are as old as the leg joints of an animal body.

I send you a picture of the “Dragon Fly”. It would not fly as a kite and develop its basic principle. For its stability, it depends on its speed whereby the impact, or rather projective force comes into play to sustain it in its line of direction. You will note that only a part of the tail vanes incline for steering. The major part remain parallel to line of direction to feather or steady the machine, and I think similar small steadying vanes in same parallel (not inclined) distributed along the shaft line, would be an advantage to act like a keel or centerboard. You know the difference between rowing a smooth bottom dory and a keel boat.

I will send you detail of turbine motor as soon as I can get to it. This letter and the extract is for the Bulletin if you wish.

(Signed) H. Percy Blanchard.

The “Dragon Fly” Illustrating the Blanchard Article

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A VIEW AHEAD FROM THE LAST CENTURY by H. P. Blanchard

Just then, skimming over a low hill-top about a mile away, and perhaps a hundred and fifty feet above the ground, Mr. White pointed out to me the mail courier.

I had been looking with some expectation away up in the clouds, trying in vain to resolve an imaginary dot or distant bird into a flying machine. So I was a good deal surprised to see the reality in the direction indicated. It was not what I had expected.

I had fancied I might see a huge elongated baloon, some way or other propelled, or maybe a great expanse of horizontal canvas, a big aeroplane, perhaps a double or a triple decker slicing the clouds as it swooped down from the heavens. Instead, as this dragon fly thing approached, decidedly with swiftness, the view from front showed the line of an isosceles triangle inverted, its apex a very obtuse angle.

Its spread was about twenty feet, and from this base or crosstie to the lower angle was, I should judge, six feet. In the mathematical center of this traingle was a spindle, on the forward tip of which two tandem fans or propellers whirled in opposite directions. Suspended below was a light, square framed cage in which the driver sat. I had no time for further observation before the machine, keeping its speed close to the ground was almost on us; and then I saw the driver with some effort strongly press a lever down. The result was that a level sail or plane hinged at its front edge to the upper cross-tie, took an angle of some thirty degrees out of the horizontal, pointing forward and up, and the 16 2 machine, with a little lilt and rise, checked itself quickly, and gracefully settled to the ground.

The wide rimmed wheels at the extremity of four elastic shafts pointing forward and aft like the extended legs of a galloping horse, took up the small remaining motion, and, the propellers stopped, the thing was at a standstill within twenty feet of the spot where it had alighted. I had now a very welcome opportunity for examining the affair. The driver, an intelligent and agreeable young fellow of about twenty, while he waited the postmaster's pleasure, undertook to explain to me the mechanical construction of the machine.

Built above the narrow oblong cage intended for the driver, were a succession of light metal triangles shaped as I have described, and stayed with cross-wires. Their lower angles were in a line so as to form a prismatic framework, its ends inverted isosceles triangles, and its three sides rectangles about ten feet long. The under surface of the sides (except a strip about two feet wide adjacent the central bottom edge) was covered with a thin hard material like celluloid; and, over against this veneering, the inner side of the ribs, to avoid unnecessary friction, were ceiled with oiled cotton or silk.

The front triangle frames graduated larger and their lower angle more acute, with the result that the upper forward points had a very jaunty little forward tilt. A stiffened sail or mat about ten feet square occupied the middle of the rectangular level or top of the prism. When the aero was in motion, this latter plane had sustaining power, but its special use was to check the forward motion of the machine, 17 3 and give it ease in lighting.

In its flight I had not observed the, to me, extraordinary length of what I have c l a lled the spindle which ran from front to rear through the mathematical middle of the triangular framework. This spindle was fully sixty feet long, three-quarters of it abaft and one-quarter of it forward the centre of the aeroplanes. On the stem, as before mentioned, were the propellers. On the tail end were four thin surfaces about five feet long and about two feet wide, two horizontal and two perpendicular, set like the feathers of an arrow. These planes were further extended but were flexible and moved sideways or up and down as a double rudder according to the desire of the steersman.

Probably to prevent vibration, as well as for further strength, this spindle was trussed with wire, and also was firmly affixed by braces to the prismic aeroplanes. That part of the spindle inside the prism was swollen like a bulb or of torpedo shape, and at its largest diameter measured about two feet through. I could not see into it, but the driver told me that it was cellular inside like a honey-comb, and contained compressed air at a pressure of about four hundred pounds. This compressed air could be supplied either from the power-houses, or, as an auxiliary, a small cylinder of liquid air could be clamped on and utilized. The driving machinery was very simple.

The forward propeller was on a solid shaft that ran right through the bulb from end to end. For about eight feet of its length, inside the bulb, some fifty sets of little flat metal chisel teeth, two inches long, projected like successive 18 4 rows of spokes from a hub, but all like small propeller blades, turned at a certain angle in one direction. Toward the stern, these blades were a little longer and had a shade less pitch than at the bow. They were in sets and between each annular set, was a clear space of about two inches.

The spindle of the other driving fan (this was a little larger and went somewhat slower than its fellow about two feet further aft) revolved on the same centre as the other, but its shaft was a tube which fitted closely on the shaft of the other. When this outer shaft or tube reached the interior of the bulb, it expanded into a larger diameter, forming a cylinder six inches through. From the insi e d e of this cylinder, like spokes from a wheel rim, when the hub is removed, projected also a multitude of these thin chisel blades, but with a pitch counter to those bristling from the inner shaft, and in sets to occupy the vacant rings. Collars and f ? l anges on these two shafts took up all la g t eral motion but allowed them both to revolve freely.

To start the power it was only necessary to open a throttle valve, and let the expanding air through the forward box at the front end of the contra toothed cylinder L . As this air under pressure forced its way to the external opening at the further end, it drove the intervening little propellers to left or right, and sent the both shafts spinning in opposite directions. As the compressed air in its reservoir would become somewhat exhausted, the throttle valve would be opened wider to compensate. The little mail bag had now arrived and was put with the other trifling freight in a canvas saddle or jacket slung around the bulb. We waited to see the machine 19 5 start.

The driver (who also was captain, engineer, purser, postman and the crew) firs gave the rear of the upper horizontal hinged plane a tilt of about ten degrees downward. Then his tiller turned the rudder tail to an opposite but even more decided slant. The spectators seemed to understand the coming manoeuvers and gave a clear, right away.

As the throttle opened, slowly the fan propellers began to swirl, then swifter, as the aero gently started forward/, acquiring speed at every yard, until at last from a slight elevation in the roadway it disdained the ground, and like a white winged bird with outstretched pinions on its native element it soared aloft and quickly floated far away from sight.

The firs fact that occurred to me, and which I remarked to Mr. White as we were walking homeward, was that, taking the machine all for all, there was not a single mechanical principle nor motive force that was not perfectly familiar to our inventors, years before the beginning of the century. “That is so”. “Well, how comes it that the flying machine then was not in use long before 1912?” “There are two reasons. Leaving aside any theory to the effect that inventions, like other inspirations, are only given to mankind when on the Almighty's calendar the time is ripe; and that the Ruler of the Universe removes the scales from some ones eyes and discloses, as its hour arrives, some combination maybe of simple principles common to the race for perhaps a thousand years; and which theory has been advanced to explain why two inventors continents apart, honestly and without collusion discover or 20 6 uncover the same idea at the same moment;— leaving this theory aside, you will notice that, while machinists had the mechanical principles, they had not perfected in union the arts of balancing. I say in union, because the several and separate ideas were well understood. The Scientific possibilities of the aeroplane were thoroughly comprehended. The metal-pointed, feather-tipped arrow had made us Saxons victors in the far days of Cressy. When Mechanics properly combined the arrow and the aeroplane, then was the flying machine. For years, it is true, the wings had been perfected; they forgot entirely the tail. Without the latter, the aeroplane dived here and there, was uncontrollable. It was folly to attempt a canter through the clouds on such an unbroken pegasus. Even with the weighted wings, the further mistake was made of suspending the burden and driving power like a keel instead of centering it.

By putting the main weight and propellers in the middle between the planes, the air resistance or surface friction on the planes was always balanced on the center of impact and propulsion. A very light pendulum would serve to keep the airship in an even keel. Instead, with the balance not respected, an eddying gust or varying wind would continually increase or diminish the friction on the light aeroplanes; while the energy or inertia of the heavier parts suspended would not feel a corresponding start or stoppage; and the top-heavy, or rather, top-light affair would loose its equilibrium. But, with the arrow centered within its sustaining wings, the solution was found. None the less, you might hand a perfect bicycle to a skilled mechanic; it would be one thing to 21 7 understand its subtle principles, an altogether different thing to ride and master it. So with the air-cycle; only that with the latter a tumble or an accident meant death.

Experiment thus was circumscribed. However, with the wireless telegraphy, a steering gear with valves like an pneumatic organ under compressed air was easily constructed. By his corresponding tiller safely fixed on Mother-earth the manager through his conjoining electric force could steer his model air-ship high above.

After many failures, and much delicate material smashed to atoms; ultimately the proper proportions and right methods were discovered; and then, with heart of oak and triple brass the first bold captain on the Etherial sea launched out, and the motor airship was in being."